

**EXHIBIT 3**  
**FLORIDA ARCHITECTS SPECIFICATIONS VOLUMES 1 AND 2**



**BAY COUNTY**  
SHERIFF'S OFFICE  
Sheriff Tommy Ford

**BID SET PROJECT MANUAL/SPECIFICATIONS**  
for the  
**BAY COUNTY JAIL**  
**SUBSTANCE ABUSE UNIT**  
**VOLUME ONE DIVISIONS 00 - 14**  
**Panama City, Florida**  
April 19th, 2024



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## SECTION 00 80 00 – SUPPLEMENTARY GENERAL CONDITIONS

SUPPLEMENTS TO A.I.A. DOCUMENT A201, 2017 EDITION  
GENERAL CONDITIONS FOR THE CONTRACT FOR CONSTRUCTION  
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### GENERAL

These Supplementary General Conditions modify, change, delete from, or add to the "General Conditions of the Contract for Construction," A.I.A. Document A201, 2017 Edition. The A.I.A. Document A201, 2017 Edition is hereby made a part of every Section of these Specifications and shall be binding upon each Contractor, Subcontractor, and Material Supplier. Where any Article of the General Conditions is modified, or any Paragraph, Subparagraph, or Sub-Subparagraph thereof is modified or deleted by these Supplementary General Conditions, the unaltered provisions of the Article, Paragraph, Subparagraph, or Sub-Subparagraph shall remain in effect.

### ARTICLE 1: GENERAL PROVISIONS:

#### 1.1 BASIC DEFINITIONS:

1.1 Supplement Paragraph 1.1 as follows:

“1.1.1.1 The General Contractor’s Forms as accepted by the Owner shall be a part of the Contract Documents.

1.1.9 "Provide", as used in the Contract Documents, includes furnishing all labor, supervision, tools, materials, supplies, equipment, shop drawings, product data and samples, together with all services, accessories and costs associated with performance of the work, or production or installation of an item or system usable in the complete project.

1.1.10 “Diagrammatic”, as used in the Contract Documents, shall mean to outline in schematic form or an illustration to be used as a guide only.

1.1.11 “Product”, as used in these Contract Documents, includes materials, systems and equipment.

1.1.12 Federally Assisted Construction Contract. The regulation at 41 C.F.R.

§ 60-1.3 defines a “federally assisted construction contract” as any agreement or modification thereof between any applicant and a person for construction work which is paid for in whole or in part with funds obtained from the Government or borrowed on the credit of the Government pursuant to any Federal program involving a grant, contract, loan, insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee, or any application or modification thereof approved by the Government for a grant, contract, loan, insurance, or guarantee under which the applicant itself participates in the construction work.

1.1.13 Construction Work. The regulation at 41 C.F.R. § 60-1.3 defines “construction work” as the construction, rehabilitation, alteration, conversion, extension, demolition or repair of buildings, highways, or other changes or improvements to real property, including facilities providing utility services. The term also includes the supervision, inspection, and other onsite functions incidental to the actual construction.”

#### 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS:

1.2.1 Delete subsection entirely and substitute the following:

“1.2.1 The intent of the Contract Documents is to include all items necessary for the execution and completion of the work by the Contractor. The Contract Documents are complementary, **and what is required by any one shall be as binding as if required by all**. Performance by the Contractor and Subcontractors shall be required

to produce the intended results. In cases of discrepancies between the Contract Documents, the Agreement shall take precedence over the Drawings and Specifications, and the Specifications shall take precedence over the Drawings, except as listed. Large scale plans, sections, and details take precedence over smaller scaled items. Plan schedules shall control over general plans. Addenda and Change Orders supersede only affected portions of the Documents.

1.2.1.1 The Contractor/Subcontractor, however, shall be held to providing completed work, according to the meaning and intent of the Drawings and Specifications whether all of the items involved under any trade are mentioned in one or several sections or on one or several drawings.

1.2.1.2 Should any item to be furnished or labor to be performed as specified under more than one Section of the Specification, it will be premised that Subcontractors have included said product and/or labor in more than one Section, unless he shall have obtained a written decision from the Contractor prior to the bid. The Contractor will decide who shall provide such items. Proper credit shall be given to the Owner when the cost has been included more than once.

1.2.1.3 Should any item or equipment required to be furnished within the drawings or specifications fail to have any or all of its connections or utilities indicated, the Contractor and Subcontractors shall provide (as a minimum) services, utilities and connections to ensure the permanent, proper, code compliant operation of the item or equipment; unless such condition shall have been brought to the attention of the Architect prior to the Bid and a decision rendered through the issuance of addenda or other items of clarification.

1.2.1.4 The Contractor, and Subcontractors shall not take advantage of errors or omissions on Drawings or Specifications.

1.2.1.5 If any errors or omissions appear in Drawings, Specifications, or other Contract Documents, the Subcontractors shall notify the Contractor before time of submitting bid. The Contractor will notify and resolve the issues with the Architect prior to submitting a Price, or Bid Proposal to the Owner. Should conflict occur in or between Drawings and Specifications; Contractor and Subcontractors are deemed to have estimated on the more expensive product, method of installation, and/or the greater quantity, unless he has requested and obtained a written decision before submission of bid proposals as to which method, product, or quantity will be required.

1.2.1.6 References to known standard specifications shall mean the latest edition of such specifications adopted and published at date of invitation to submit proposal. Words which have well-known technical or trade meanings are used herein accordance with such recognized meanings.

1.2.1.7 When dimensions as shown on the Drawings are affected by conditions already established, the Subcontractor shall take measurements to verify the given scale or figure dimensions in the Drawings.

1.2.1.8 The Specifications, detailed description or omission of it, concerning any work to be provided shall be regarded as meaning that only the best general practice of the trade is to prevail and that only materials and workmanship of the first quality are to be used. All interpretations of these Specifications shall be made upon this basis and all interpretations shall be made by the Architect.

1.2.1.9 Execute work as per Contract Documents. Make no changes without having first received written permission from the Architect. Where detailed information is lacking, before proceeding with work, refer matter to the Architect for additional information.

1.2.1.10 THE MECHANICAL AND ELECTRICAL SYSTEM DRAWINGS ARE DIAGRAMMATIC IN NATURE AND THE FIELD CONDITIONS MAY ARISE THAT WILL PREVENT THEIR BEING INSTALLED AS PER DRAWING (EX.), SUCH AS PIPE AND CONDUIT RUNS, CROSSOVERS, RISERS, DOORS, FLOOR, WALLS AND CEILING PATTERN COVERING LAYOUTS, ETC. THEREFORE, IT SHALL BE THE RESPONSIBILITY OF EACH AND ALL SUBCONTRACTORS, FOR THE COORDINATION, TIMING AND PROTECTION OF ALL CONDITIONS; AND IN EACH CASE WHERE THERE IS ANY QUESTION OR PROBLEM AS TO CONDITIONS OR LOCATIONS OF THESE ITEMS, SUBMIT A WORKABLE SOLUTION TO THE CONTRACTOR/GENERAL CONTRACTOR AND THE ARCHITECT FOR REVIEW AND WRITTEN APPROVAL BEFORE COMMENCING WITH QUESTIONABLE WORK. IF SUCH ADJUSTMENT SHALL BE MADE BY THE SUBCONTRACTOR WITHOUT WRITTEN APPROVAL, IT SHALL BE AT THEIR OWN RISK AND EXPENSE. ANY REMOVAL OF NON-APPROVED AREAS SHALL BE THE RESPONSIBILITY AND EXPENSE OF THE SUBCONTRACTORS.

1.2.1.11 Where there is conflict between the Drawings, or between Drawings and Specifications, or doubt as to meaning, the Contractor and Subcontractors shall obtain a written decision from the Architect, except where the Contractor deems that there could be immediate damages to life or property. He shall not proceed in uncertainty in any instance.

1.2.1.12 In the case of discrepancies between the INFORMATION TO BIDDERS, CONDITIONS OF THE CONTRACT, DRAWINGS, SPECIFICATIONS, OR ADDENDA as it relates to each Subcontractor's Work Category responsibilities, the most stringent and/or most expensive case applies as determined by the Architect."

1.2.2 Add the following:



"1.2.2.1 Construction Specifications Institute (C.S.I. Uniform System): To assist the Contract, the Specifications are divided into Divisions and Section numbers generally conforming to "Uniform System for Construction Specifications."

ARTICLE 2:  
OWNER:

2.1 GENERAL:

2.1.1 Add the following subparagraphs:

"2.1.1.1 THE TERM "ARCHITECT" AS USED IN THE GENERAL CONDITIONS SHALL MEAN FLORIDA ARCHITECTS, INC. where the term "A/E", "Architect/Engineer", or "Engineer" is used in the documents, it shall be considered as being synonymous with the term "Architect" as defined in the general conditions.

2.1.1.2 The use of phrases "as directed", "as instructed", "reviewed", "authorized", "accepted", and similar terms implies that such action will be taken by the Architect unless specifically stated otherwise."

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER:

2.2.5.1 Add the following:

"2.2.5.1 The Contractor will be furnished with ONE (1) reproducible digital (PDF format) set of Drawings and Specifications by the Owner (other sets may be furnished but are not a requirement under this contract). A complete set of portable document format (.pdf) documents (plans and specifications) will be made available to the Contractor for their printing processes. The Contractor will make the portable document format documents available to the Subcontractors for their use in this project. The Architect will provide the Contractor with the original digital AutoCAD 2021 files of the Plans (plan views only) for the Contractor's and Subcontractor's use to prepare Shop Drawings, Coordination Drawings, and Submittals upon receipt of accepted Architect's Digital File Release Forms from all users."

2.4 OWNERS RIGHT TO CARRY OUT THE WORK:

2.4.1 Add the following:

"2.4.1 The Owner and/or Owner's Agent(s) will assist the Architect and Contractor in determining in general that the Work of the Subcontractors is being performed in accordance with the Contract Documents and will endeavor to guard the Owner against defects and deficiencies in the Work of the Contractor and Subcontractors."

ARTICLE 3:  
CONTRACTOR:

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR:

3.2.1 Add the Following:

"3.2.1.1 Examination of site shall include determination of the nature and scope of the work and all difficulties that accompany its execution."

3.2.3 Add the following:

"3.2.3.1 The Contractor, Subcontractors and material suppliers shall examine the Architectural, Structural, Mechanical, Plumbing, and Electrical Drawings and Specifications, and verify all measurements and requirements before ordering materials or performing any work to avoid problems during construction.

3.2.3.2 Before ordering materials or doing any work, the Contractor and Subcontractors shall verify all measurements at the project site and shall be responsible for their correctness. No extra compensation will be allowed on account of differences between actual dimensions and those indicated on the Drawings. Any decided difference which may be found shall be reported to the Architect in writing, for consideration before proceeding with the Work."

3.4 LABOR AND MATERIALS:

3.4.1 Add the following:

"3.4.1.1 Material Standards - Unless otherwise specifically provided in this Contract, reference to any equipment, material, article, or patented process, by trade name, make, or catalog number, shall establish a standard of quality and the Base Bid shall include only materials and items exactly as specified or called for by name. Architect to list at least three acceptable manufacturers in the Specifications, where possible, however each manufacturer shall meet the basis-of-design requirements.

3.4.1.2 Contractor must comply with the UNIFORM FEDERAL CONTRACT PROVISIONS RIDER FOR FEDERALLY FUNDED PROCUREMENT CONTRACTS (Version 02.16.18) – Refer to Section 00 10 00, Instructions to Bidders, Exhibits “M” and “N” for additional requirements.

3.4.1.3 Contract Work Hours and Safety Standards Act 40 U.S.C. §§ 3702 and 3704, as supplemented by Department of Labor regulations at 29 C.F.R. Part 5:

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The City of Lynn Haven, Florida shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or Subcontractor under any such contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or Subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.

(4) Subcontracts. The Contractor or Subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any Subcontractor or lower tier Subcontractor with the clauses set forth in paragraphs (1) through (4) of this section.

3.4.1.4 Compliance with the Davis Bacon Act: The prime Contractor for this project must be in compliance with the Davis-Bacon Act (40 Current as of 1-9-17 U.S.C. §§ 3141-3144 and 3146-3148) as supplemented by Department of Labor regulations at 29 C.F.R. Part 5 (Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction)). See 2 C.F.R. Part 200, Appendix II, ¶ D.

(1) In accordance with the statute, Contractors are required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, Contractors are required to pay wages not less than once a week.

(2) Also refer to Section 00 10 00, Instructions to Bidders, Exhibits “M” and “N” for additional requirements.

3.4.1.5 Compliance with the Copeland “Anti-Kickback” Act (40 U.S.C. §3145), as supplemented by Department of Labor regulations at 29 C.F.R. Part 3(Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States):

(1) Contractor. The Contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract.

(2) Subcontracts. The Contractor or Subcontractor shall insert in any subcontracts the clause above and such other clauses as the FEMA may by appropriate instructions require, and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any Subcontractor or lower tier Subcontractor with all of these contract clauses.

(3) Breach. A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a contractor and subcontractor as provided in 29 C.F.R. § 5.12.”

3.4.2 Delete subparagraph 3.4.2 and substitute the following:

“3.4.2 Substitutions During Bidding Period - Requests for Substitutions during the bidding period will be considered and treated only as stated in Specification Section 00 82 00, Special Conditions, Article 15, Substitution of Materials and Equipment. Once bids have been received, the Owner and Architect will prepare the Contract on the basis that all items are those specified in the Specifications, shown on the Drawings, or approved in Addenda during the bidding period. The approval of a product during the bid period does not negate the requirement for the submission of complete data during the construction in accordance with the Section 01 33 00,

Submittals, nor does it negate the burden of complying with all specification requirements. Should further investigation of a product approved during the bid period indicate that the product does not meet the essential requirements of the project the Contractor and Subcontractors shall make such modifications as are necessary to meet these essential requirements.

3.4.2.1 Approval After Bids are Opened - Substitutions or approval of products will be considered after bids are opened only under the following conditions:

.1 The Subcontractor shall place orders for specified materials and equipment promptly upon award of Contract. No excuses or proposed substitutions will be considered for materials and equipment due to unavailability, unless proof is submitted that firm orders were promptly placed for the item listed in the Specifications.

.2 The reason for the unavailability shall be beyond the control of the Subcontractor, such as strikes, lockouts, bankruptcy, discontinuance of the manufacturer or a product, or acts of god, and shall be made known in writing to the Architect within ten (10) days of the date that the Subcontractor ascertains that he cannot obtain the material or equipment specified. Requests shall be accompanied by a complete description of the materials or equipment which the Subcontractor wishes to use as a substitute."

### 3.5 WARRANTY:

3.5 Add the following:

"3.5.1 Under this warranty for a period of one (1) year from date of Completion, as evidenced by the date of "Substantial Completion" of the Work, the Contractor and Subcontractors shall remedy, at his own expense, any such failure to conform on any such defects. Where warranties are written in any Section for longer than one (1) year, such terms will apply.

3.5.2 Nothing in the above intends or implies that this warranty shall apply to work which has been abused or neglected by the Owner."

### 3.6 TAXES:

3.6 Add the following:

"3.6.1 Unless otherwise specified, the Bid price includes all Federal, State and local taxes imposed prior to the execution of the Agreement and which are applicable to the Work. If any new privilege, sales gross receipt or other excise tax, exclusive of taxes and net income or undistributed profit applicable to the Work and payable by the Subcontractor is imposed by the State of Florida, or such present tax be increased as of the date thereof, then the Contract price will be adjusted accordingly and the Owner will reimburse the Contractor therefore without any allowance for overhead or profit upon separate payment application containing such pertinent details as the Owner may require. The Contractor will organize, implement and manage the Owner's direct purchase tax recovery program. Direct purchases shall be for orders of five-thousand dollars (\$5,000) or more for any single item."

### 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS:

3.7 Delete paragraph 3.7.1 and substitute the following:

"3.7.1 A local building permit will be required for this project. The "Florida Building Code 2020 shall govern. The Contractor will engage a qualified **Building Department** to facilitate the document review and building permit process, as well as, related inspection services in accordance with the FBC. The Owner is **NOT** exempt from any and all other county, district, municipal, and local building codes, ordinances, interpretations, building permits and assessments of fees for building permits, impact fees and service availability fees other than those defined within the Florida Building Code 2020, the Florida Statutes and the Florida Administrative Code. The Contractor and Subcontractors shall secure all required permits, governmental fees, anti-pollution fees, and licenses necessary for the proper execution and completion of his Work, which are applicable at the time the bids are received. The Contractor and Subcontractors shall be familiar with all Federal, State, and local laws, codes, ordinances, and regulations which in any manner effect those engaged or employed in the Work and any material or equipment used in the conduct of the Work.

3.7.1.1 Before proceeding with the Work, securing permits or necessary licenses, the Contractor and Subcontractors shall carefully study and compare the Drawings and Specifications and shall at once report in writing, to the Architect/Engineer, any error or omission he may discover that is in variance with applicable laws, statutes, building codes, and regulations."

3.7.2 Add the following:

"3.7.2.1 The Contractor and Subcontractors at all times shall comply with the Florida Building Code 2020 installation requirements (including amendments and supplements), and all Federal, State and local laws, codes, ordinances and regulations as applicable, which in any manner affects the Work, and he and his surety shall

indemnify and hold harmless the Owner, and Architect/Engineer, to the extent allowable by law, against any claim or liability arising from or based on the violation of such law or decree, whether by himself or his employees.”

3.7.3 Add the following:

“3.7.3.1 Requirements under the Federal Uniform Rules 2 C.F.R. § 200.326 and 2 C.F.R. Part 200, Appendix II, Required Contract Clauses are hereby made a part of this contract.”

### 3.11 DOCUMENTS AND SAMPLES AT THE SITE:

3.11.1 Add the following:

“3.11.1 At the completion of the Work, each Subcontractor shall submit "Record Drawings" to the Contractor on digital media, and the Contractor in turn will produce (or cause to have produced) As-Built Drawings on ELECTRONIC MEDIA on Autodesk AutoCAD Architectural Desktop (2021 Version). The Architect will provide the Contractor with the digital related AutoCAD files of the project for the Contractor's and Subcontractor's use to prepare Shop Drawings, Coordination Drawings, and As-Built (Record) Drawings upon receipt of accepted AIA Documents E203-2013 and G201-2013 Digital Protocol Agreements and the Architect's Digital File Release Forms from all users. Said Record Drawings shall be delivered to the Architect for review. The Architect will forward reviewed Final As-Built Drawings to the Owner for their future use.

3.11.1.1 Pipelines and ducts which are installed in furred spaces, pipe chases, or other spaces which can be readily inspected by the use of access panels or other means of access will not be considered as being concealed. With reference to electrical and mechanical work the exact (not diagrammatic) conduit, pipe, and duct runs shall be shown on these drawings.

3.11.1.2 Record Drawings" shall be the daily in-use set of contract documents at the job site. At the end of each day, the foreman of each trade shall mark and date any and all changes that occurred during the course of the days work. Lines shall be located by dimension and equipment shall be noted and located. These documents will be delivered to the Contractor as noted in 3.11.1 above.

3.11.1.3 Upon completion of the work this data shall be recorded to scale, by a competent draftsman on electronic media copies of the contract drawings. Where changes and actual locations are to be recorded, the electronic media shall be erased before the changes are made. The work shall be shown as installed and the Contractor shall deliver the black line drawing prints and electronic media files with every drawing marked "As-Built". In showing the changes the same legend shall be used to identify piping, etc., as was used on the contract drawings. A separate set of drawings shall be prepared for electrical, plumbing, heating, air conditioning, and ventilating work, and A/V & Data, unless two (2) or more divisions are shown on the same sheets of the contract drawings. Each change of the original Contract Documents shall be "clouded" and referenced, except pipe runs may be noted, and each sheet shall bear the date and name of the Subcontractor submitting the changes to the drawings.

3.11.1.4 The Contractor shall review the complete as-built drawings. He shall ascertain and certify that all data furnished on the drawings are accurate and truly represent the work as actually installed. When manholes, boxes, underground conduits, plumbing, hot or chilled water lines, inverts, etc. are involved as part of the work, the Subcontractor shall furnish true elevations and locations, all properly referenced by using the original benchmark for the project. The "Record Drawings" from each Subcontractor, including those unchanged and changed, shall be submitted to the Architect, when completed, together with two (2) sets of black line prints (produced from the As-Built Electronic Media) with the Contractor's stamp and each Subcontractor's certification for forwarding to the Owner, at the time of Substantial Completion. Final payment shall not be made until said "As-Built" documents have been received by the Architect, reviewed and accepted as complete, and in accordance with the contract documents.

3.11.1.5 The Contractor shall be responsible for collecting, identifying, indexing and collating the specified Close-Out Documents including the following materials from the Subcontractors, and will deliver two (2) copies of the finished documents to the Architect. Complete equipment diagrams, operating instructions, maintenance manuals, parts lists, wiring diagrams, pneumatic and/or electrical control diagrams, test and balance reports, inspection reports, guarantee and warranties, as applicable for each and every piece of fixed equipment furnished under this contract to be supplied in a three-ring binder, hard-cover book, properly indexed for ready reference. Also, specific information regarding manufacturer's name and address, nearest distributor and service representative's name and address, office and home phone numbers, make and model numbers, operating design and characteristics, etc. will be required. All information submitted shall be updated to reflect existing conditions. Final payment shall not be made until said documents have been received by the Architect/Engineer, reviewed and accepted as complete and in accordance with the contract documents. Also refer to Section 01 77 00, Close-Out Procedures.”

### 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES:

3.12.11 Add the following Subparagraph:

“3.12.11 The requirements of Article 3.12 are supplemented by a separate Section, Submittals in Division One, Section 01 33 00.”

3.14 CUTTING AND PATCHING OF WORK:

3.14 Add the following Subparagraphs:

“3.14.3 The Subcontractor shall do all cutting required for installation of his work. Patching required because of such cutting shall be performed as follows:

3.14.3.1 Wherever cutting occurs within unexposed materials, or in materials which are to remain unfinished when completed, patching shall be performed by the Subcontractor who did the cutting. This includes all concrete and masonry other than listed below.

3.14.3.2 Wherever cutting occurs in finished surfaces, patching shall be performed by the Subcontractor specializing in that particular trade, and paid for by the Subcontractor who did the cutting. This includes, but is not limited to, roofing, painting of plaster and finished surfaces, ceramic tile, structural facing tile, marble, concrete block in finished areas, metal lath and plaster, acoustical materials and their supports.”

ARTICLE 4:  
ARCHITECT:

4.1 GENERAL:

4.1 Add the following paragraph:

“4.1.4 Disputes arising under Subparagraph 4.1.2 and 4.1.3 shall be subject to litigation with venue solely in Bay County, Florida.”

ARTICLE 5:  
SUBCONTRACTORS:

5.1 DEFINITIONS:

5.1. Add the following:

“5.1.3 Material Supplier is a person or organization who has furnished materials to the General Contractor, Subcontractor, Sub-subcontractor or Owner to be used in the construction of the Work, a building or structure, but has not performed any on or off-site work other than delivering construction materials, and shall not have or created any contractual relation between the Owner or the Architect/Engineer.

5.1.4 The Contractor, and all Subcontractors, Sub-Subcontractors and Material Suppliers shall be responsible for reading, studying, and understanding the Conditions of the Contract, Drawings and Specifications.”

ARTICLE 6:  
CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS:

6.4 Add the following paragraph:

“6.4 INSTALLATION OF EQUIPMENT:

6.4.1 The Contractor and Subcontractors shall allow the Owner to take possession of the use of any completed portions of this structure or Work, or to place and install as much equipment and machinery during the progress of the Work, as is possible without interference before its entire completion. Such possession and use of structure of work or such placing and installation of equipment, or both, shall not in any way evidence the completion of the Work or any portion of it, or signify the Owner's acceptance of the Work or any portion of it.”

ARTICLE 7:  
CHANGES IN THE WORK:

7.3 CONSTRUCTION CHANGE DIRECTIVES AND CHANGE ORDERS:

7.3.3 Delete paragraph and substitute the following:

“7.3.3 The cost or credit to the Owner resulting from a change in the Work shall be determined as follows:

1. By Unit Prices stated in the Contract Documents; or for changes not covered by Unit Prices;

2. By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation; or if no agreement can be reached,
3. By the method provided in Subparagraph 7.3.6.

The lump sum proposals shall be based upon:

1. Estimate of Labor.
2. Estimate of Materials.
3. Estimate of Applicable Taxes.
4. Estimate of Equipment Rentals.
5. Estimate of Subcontractor Costs (separate line for Profit & Overhead).
6. Estimate of Contractor Costs (separate line for Profit & Overhead).
7. Estimate of Field Supervision (directly attributed to change) shall be included in labor breakdown.
8. Cost of Bond Premium and insurance.
9. Contractor and Subcontractor overhead and profit applied to the above items shall not exceed twenty percent (20%) percent in total. Subcontractor overhead and profit shall not exceed ten percent (10%). Contractor overhead and profit shall not exceed ten percent (10%) plus the cost for related insurance and bond premium. All lump sum proposals shall include a detailed cost breakdown for each component of work including material and labor, equipment rentals, taxes, supervision, profit and overhead. Indicate both quantities and unit prices. Include supplier quotes or invoices. Submit to the Architect within seven (7) consecutive calendar days after receipt of the proposal request for review and comments.”

7.3.7 Add the following:

“7.3.7.1.1 All labor, material, and equipment expenditures for work performed at actual cost shall be approved daily by the Contractor. Material invoices shall be presented to the Owner and Architect with all payment requests.

7.3.7.1.2 No amount or percentage of overhead and profit will be allowed on items of perks, fringe benefits, bonuses, retirement benefits (other than social security withholdings), or health and life insurances.”

7.5 Add the following:

“7.5 ACCESS TO RECORDS:

7.5.1 The following access to records requirements apply to this contract:

(1) The contractor agrees to provide the City of Lynn Haven, Florida, attention City Manager, the FEMA Administrator, the Comptroller General of the United States, or any of their authorized representatives access to any books, documents, papers, and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions.

(2) The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

(3) The contractor agrees to provide the FEMA Administrator or his authorized representatives access to construction or other work sites pertaining to the work being completed under the contract.”

## ARTICLE 17: EQUAL OPPORTUNITY:

ADD the following Article:

“17.1 The Contractor shall maintain policies of employment compliant with the following:

17.1.1 Neither the Contractor or any Subcontractors will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

17.1.2 The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

17.1.3 The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

17.1.4 The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

17.1.5 The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

17.1.6 In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

17.1.7 The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States."

END OF SECTION 00 80 00



## SECTION 00 82 00 – SPECIAL CONDITIONS

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Attachment: Certificate of Substantial Completion Form

Attachment: Certificate of Contract Completion Form

Attachment: Warranty-Guarantee Form

### PART I - GENERAL REQUIREMENTS:

These Special Conditions are hereby made a part of every Section of these Specifications and shall be binding upon each Contractor, Subcontractor, and Material Supplier. Notice of Commencement shall be filed at the Bay County Courthouse.

#### ARTICLE 1: PERMITS AND FEES:

- A. Building Permit: A local building permit **IS** required for this project. The Contractor shall obtain and pay for all required reviews, approvals and inspections for the project. The Contractor, Subcontractors, and Suppliers shall cooperate with the Owner in obtaining required approvals and inspections.
- B. Utility service connection fees (if required) and required utility service fees, if any, will be coordinated by the Contractor and paid for by the Contractor.
- C. Threshold and Special Inspections: The Owner will contract with professional qualified and licensed firms to provide any required Threshold Inspections and other special inspection requirements. The Contractor shall cooperate with the Owner's consultants to coordinate and schedule the required site inspections.
- C. Other Permits and Fees: Other than as noted above, the Contractor shall assist in obtaining and arranging for payment for all other reviews, permits, assessments, fees, bonds, and other charges as necessary to perform and complete the work of this contract, including any related inspection fees, in accordance with the contract between the Owner and the Contractor.
- D. The Contractor and Subcontractors will be subject to all applicable County and local Municipal Occupational License Fees and Taxes.

ARTICLE 2: PROJECT SIGNS:  
See Bay County Documents

ARTICLE 3: LAYOUT OF WORK:

- A. All work, and in particular piping, ducts, conduit, and similar items, shall be neatly and carefully laid out to provide the most useful space utilization and the most orderly appearance. Except as otherwise indicated or directed, piping and similar work shall be installed as close to ceilings and walls as conditions reasonably permit, located to prevent interference with other work or with the use of the spaces in the manner required by the functions of the space as determined by the Construction Manager, Owner and Architect. Valves and clean-outs shall be located in inconspicuous but accessible locations and shall be field verified before proceeding with any work where exposed to view. The Contractor and Subcontractors shall carefully plan the layout and review any questionable installations with the Contractor and the Architect.

ARTICLE 4: TEMPORARY FENCING AND SECURITY:

- A. A temporary fencing enclosure **WILL BE** required for the duration of the construction period. The temporary fencing may need to be modified by the Contractor for the various phases of construction. Refer to the Architect's Site Plan for limitation of construction area(s), access and gate locations, etc.
- B. The services of a watchman will **NOT** be provided by the Owner or the Architect. The Contractor shall be responsible for, and make good, any loss due to theft or vandalism during construction for any claim not covered by Builder's Risk Insurance.
- C. Subcontractors shall advise the Contractor and the Architect of any theft or damage which might delay the execution of the Work.
- D. See SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS for additional requirements.

ARTICLE 5: MATERIAL STORAGE:

- A. Each Subcontractor shall provide sufficient protection for his materials and equipment from damages by weather or construction work, or theft. Location shall be coordinated and approved by the Contractor. During progress of work daily and upon completion of the work daily, remove all debris and leave the area in a clean and orderly condition.
- B. See SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS for additional requirements.

ARTICLE 6: TEMPORARY TOILET FACILITIES:

- A. The Contractor will obtain and maintain sanitary temporary toilet facilities acceptable to the local Health Department for use by all crew and workmen.
- B. Contractor and Subcontractors will not have access to existing toilet facilities within this facility or the adjacent buildings for the use of his crew and workmen.
- C. See SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS for additional requirements.

ARTICLE 7: USE OF PREMISES, BARRICADES AND PROTECTION:

- A. Subcontractors shall be subject to such rules and regulations for the conduct of the Work as the Contractor, Owner or Architect may establish.
- B. Before entering upon the Work, ascertain from the Contractor, as approved by the Owner and Architect, what entrances, routes, or roadways shall be used for access to the work, and use only the entrance, routes, and roadways designed for movement of personnel, materials, and vehicles to and from the work.
- C. Contractor shall provide and maintain in good repair barricades, fences, overhead protection, guard

- railings, etc., as required by law or necessary for the protection of the public and personnel engaged in the Work from hazards incidental to this contract. Take reasonable precautions necessary to protect Owner's employees, the public, and workmen from injury or damage to vehicles or other property.
- D. Whenever the Contractor intends to depart from the normal work hours, he shall notify the Owner and the Architect at least twenty (20) hours in advance. Failure of the Contractor to give such timely notice may be cause for the Architect to require the removal or uncovering of the Work performed during such time without the knowledge of the Architect but is subject to the approval of the Owner.
  - E. Protect pavement, curbs, and all existing construction and improvements during the course of the Work and repair all parts of same which become damaged. Contractor and each Subcontractor shall be responsible for the necessary cleaning and repairing of adjacent streets and other improvements resulting from his operations.
  - F. Each Contractor and Subcontractor shall be responsible for all damage to the Owner's property and this project due to his operations. Repair or replacement of damaged items shall be to the satisfaction of the Owner and the Architect.
  - G. Provide and maintain proper shoring and bracing for existing underground utilities, sewers, and building foundations, encountered during excavation work to protect them from collapse or movement, or other type of damage until such time as they are removed or repaired, incorporated into the new work, or can be properly backfilled upon completion of new work.
  - H. Maintain clearances adjacent to and in connection with the work performed.
  - I. The Contractor and each Subcontractor shall effectively confine dust, dirt, and noise to the actual construction areas.
  - J. All employees and people on-site shall maintain procedures as stated in the Contractor's safety program.
  - K. Each Subcontractor shall assume full responsibility for the protection and safekeeping of products under his control which are stored on the site. Subcontractors must move any stored products, under Subcontractor's control, which interfere with operations of the Contractor, Owner or other Subcontractors as directed by the Contractor.
  - L. Contractors and Subcontractors must also obtain and pay for use of additional storage or work areas needed for his operations. The Contractor shall receive from each Subcontractor, a receipt of shipment for all materials and equipment stored on-site (or off-site if approved). No materials or equipment shall be removed from the site without the permission of the Contractor and the Owner. No materials may be stored off-site unless approved in writing by the Contractor, Architect and Owner.
  - M. Contractor and each Subcontractor shall not load or permit any part of a structure to be loaded with a weight that will endanger its safety, or the safety of persons or property.
  - N. All employees of the Contractor and Subcontractors shall conduct themselves in a proper manner. Any disruptive behavior by any employee will cause that employee to be barred from the construction site and the Owner's property. The use of AM/FM radios is prohibited. Animals are not allowed on the property.
  - O. All pumping, bailing, or well point equipment necessary to keep excavations and trenches free from the accumulation of water during the entire progress of this work shall be the responsibility of the Contractor performing said excavations and trenches due to their scope of work. Dispose of water in such a manner as will not endanger public health or cause damage or expense to public or private property. Abide by the requirements of all public agencies having jurisdiction.
  - P. Contractor shall prepare a Safety Plan which clearly delineates areas for construction, safety barriers, exits, construction traffic during the various phases of the project prior to initiating construction. Contractor to submit the Plan to the Architect and Owner.

ARTICLE 8: TEMPORARY FIELD OFFICES FACILITIES AND PARKING:

- A. The Contractor, Owner and the Architect will designate an area for construction trailers (to be provided by the Contractor), equipment and parking for all construction workers. Placement and schedule shall be coordinated with the Owner.
- B. Contractor shall provide a temporary field office with a meeting room of adequate size, and other

temporary buildings as may be necessary for the operations as approved by the Architect and Owner. Storage and maintenance facilities shall be as required in accordance with the local Fire Marshall having jurisdiction. The Contractor shall arrange for the temporary electrical service and other utilities in his area for their use.

- C. The Contractor and/or Subcontractors shall maintain his designated space for office and sheds if provided. This includes removal of weeds, debris, and trash. Site shall be cleaned at the end of each day's work. Clean and restore space at completion of the work.
- D. Field offices and sheds shall not be used for living quarters.
- E. Offices and sheds, when provided, shall be of suitable and safe design, maintenance, and appearance. Temporary facilities shall be securely anchored to the ground to resist 150-mph Wind Speed, Exposure C.

#### ARTICLE 9: COOPERATION - DISPUTES:

See Bay County Documents

#### ARTICLE 10: CLEANUP:

- A. Contractor and Subcontractors shall be responsible for clean-up. Each Subcontractor shall clean their respective work areas at the end of each workday and on a daily basis as a minimum.

#### ARTICLE 11: QUALITY CONTROL:

- A. It is the Contractor's and the Subcontractor's responsibility to familiarize himself with all required tolerances and quality assurance clauses, which are a part of the Contract Documents. It is also the Contractor's and the Subcontractor's responsibility to reject or condemn work performed by his forces or the Sub-Subcontractor's forces or material suppliers which does not comply with the requirements set forth in the Contract Documents, or as required by law, codes, etc. NOTE: If a conflict appears between the tolerances and quality assurance of published industry standards and the requirements of the Contract Documents, the Contract Document requirements will govern.
- B. The Owner and Architect will conduct periodic observations of the Work as it progresses. Should the Owner or the Architect reject any portion of the Work, he will promptly notify the Contractor with a Notice of Non-Conformance/Rejected Work. The Contractor will immediately provide the responsible Subcontractors with a Notice of Non-Conformance/Rejected Work and upon receipt of such notification shall, within 48 hours, inform the Contractor, Owner and Architect of his intended plan of action.
- C. The Contractor and Subcontractors should be aware that no monies will be awarded against defective work until such work is completed in a manner satisfactory to the Owner and Architect. In addition, the Architect, depending on the extent of the rejected work, may decide to withhold additional monies from the Contractor's Payment Applications to compensate for the projected cost of repairs.
- D. In the event a Subcontractor fails to cooperate in the coordination program, he will be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.
- E. When a Change Order request is issued, the affected Subcontractors shall review the Coordination Drawings and bring to the attention of the Contractor any revisions necessary to the work of others not directly affected by the change order.

#### ARTICLE 12: CHANGES TO THE WORK:

N/A

ARTICLE 13: PRIORITY:

- A. In case of close quarters for installation of mechanical and electrical systems, and in the absence of instructions to the contrary, the following order or precedence shall be followed:
1. Special Equipment and Electric Devices
  2. Light Fixtures
  3. Sheet Metal Duct Work
  4. Plumbing Work, including fire protection piping
  5. Mechanical Work, including related electrical and A/C pipes
  6. Electrical Work
  7. Control System
- B. After award of contracts and prior to start of construction the Contractor will schedule a meeting with the Contractors responsible for the work items listed above. The purpose of the meeting will be to introduce the coordination program and to determine its implementation in relation to the progress schedule.
- C. At the initial coordination meeting, the Contractor will provide to the HVAC and Electrical Contractors the drawings for the building on ELECTRONIC MEDIA in portable digital format (PDF). Contractor and Subcontractor's to use the PDF files to prepare Shop Drawings, Coordination Drawings, field dimension verifications, and As-Built Drawings. The HVAC and Electrical Contractors, with reference and consideration to the structural, mechanical, electrical, fire protection, plumbing, and reflected ceiling plans, shall draw to scale, his proposed installation showing duct sizes, equipment layouts, and dimensions from column lines and from finished floors to bottom of ducts. Ductwork shall be maintained as tight as possible to the underside of floor slabs and/or beams. In congested areas, the HVAC Contractor shall, in addition, prepare drawings in section view. During this phase of the program, it shall be the Electrical Contractor's and the Fire Protection System Contractor's responsibility to furnish the HVAC Contractor with recessed lighting and sprinkler installation and clearance requirements if these systems are specified. This information shall be outlined on the drawings by the HVAC Contractor. Also refer to Section 01 31 00, Project Management and Coordination for the required Coordination Drawings.
- D. In the event a Subcontractor fails to cooperate in the coordination program, he will be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.
- E. When a Change Order request is issued, the affected Subcontractors shall review the Coordination Drawings and bring to the attention of the Contractor any revisions necessary to the work of others not directly affected by the Change Order.

ARTICLE 14: COOPERATION WITH PUBLIC SERVICE COMPANIES:

- A. Contractors shall notify the appropriate persons within local utilities 48 hours before commencement of any work, to verify location of existing below grade pipes, cables, poles, towers, and right-of-ways that could be hazardous to life, limb, health or property. The Contractors will be held solely responsible for any injury, damage to existing utilities, or damaged property.

ARTICLE 15: SUBSTITUTION OF MATERIALS AND EQUIPMENT:

- A. All bids submitted shall be based on materials, equipment, and apparatus of the quality and make specified. The Architect will include at least three (3) approved manufacturers, as reasonably possible, but the manufacturers shall comply with the basis-of-design specifications. The Bidder's attention is directed to Section 255.04, Florida Statutes, which requires that on public building

contracts, Florida products and labor shall be used wherever price and quality are equal. However, Bidders wishing to obtain approval of an article, device, product, material, fixture, form, or type of construction other than specified or shown by name, make, or catalog number, shall make written request to the Architect timed so as to reach the Architect at least seven (7) working days prior to the date of receipt of bids. Such requests shall be accompanied by data supporting the claim to equality or equivalence.

- B. "Or Equal": The Contractor and Subcontractors shall not decide that another product is equal or equivalent to the brand, or model specified. The Architect is solely charged with this responsibility and judgment. Where "or equal" is stated in the Specifications, it is the Architect/Engineer's and not the Contractor's or Subcontractor's decision as to what brands or suppliers qualify as equal, or equivalent, or do not qualify as equal or equivalent.
- C. The Bidder shall submit drawings and other descriptive data of any modification, or items of assemblies, necessary to provide approved compliance with requirements and compatibility with adjacent components.
- D. Approval by the Architect, if given, will be made by Addendum. Said approval will indicate that the additional article, device, product material, fixture, form, or type of construction is approved for use insofar as the requirements of this Project are concerned. However, it is the responsibility of the Contractor to ensure that the approved item meets all requirements of the Contract. Bids shall not be based on assumed acceptance of any item which has not been approved by Addendum or specified herein. If a substitute item is bid without prior written approval, the Architect holds the option to void that bid, or require that the work be incorporated as specified at no additional cost to the Owner or Architect.
- E. Under no circumstance will the Architect/Engineer be required to prove that a product proposed for substitution is, or is not, equal or equivalent quality to the product specified. It is mandatory that the Bidder submit a complete description of the proposed substitute, the name of the material or equipment for which it is to be substituted, drawings, cuts, performance and test data, and any other data, samples or information necessary for a complete evaluation. Insufficient data will not be considered.
- F. Where more than one (1) manufacturer's product is listed, the listing is not necessarily in order of preference, and all will be considered as equally acceptable as long as they meet the design requirements of the Contract Documents and as determined and approved by the Architect.
- G. The Contractor shall provide the same guarantee for an approved substitution, if approved, that is originally required for the originally specified product.

#### ARTICLE 16: FASTENING DEVICES:

- A. All exposed screw and bolt heads and washers in secure spaces throughout the interior of the Project (this specifically excludes mechanical and electrical rooms) shall comply with the following:
  - 1. Any item which requires periodic access for maintenance shall have "spanner-head" fastening devices, or approved equal, which enables removal of the fastener with appropriate special tools.
  - 2. All interior exposed fastening devices shall be of tamper-proof design, wherever possible, as approved by the Architect/Engineer.
  - 3. All exterior (outside of the vapor barrier) fasteners shall be stainless steel unless otherwise specified by individual Sections.

#### ARTICLE 17: PROJECT CLOSE-OUT/DOCUMENTS:

- A. The Contractor and each Subcontractor shall be responsible for collecting, identifying, and collating the following materials, as applicable to his portion of the Work, and shall submit the same (in duplicate) to the Architect. The Contractor shall properly organize the materials from himself and the various Contractors and Subcontractors into hard cover, 3-ring binders, and shall deliver copies of the finished books to the A/E for verification. The Architect/Engineer will deliver the approved copies to the Owner for approval. This process, together with the As-Built Drawing requirements, must be

completed before the Final Certificate for Payment will be issued.

- B. INDEXING: All information shall be organized with categories indexed as per the project close-out index. The individual categories shall also be organized and indexed as per Section of the Specifications.
- C. LISTING OF CONTRACTOR AND SUB-CONTRACTORS: The Contractor shall provide a listing of all Sub-Contractors performing work on the site. Required information shall be as follows:

(Example)  
Division 1  
CM / Contractor Representative's Name  
Company Name  
Title  
Address  
Phone Number  
Facsimile Number

Division 2  
Earth Moving and Site Grading  
Representative's Name  
Title  
Company Name  
Phone Number  
Address  
Facsimile Number

- D. CERTIFICATE OF SUBSTANTIAL COMPLETION: The Contractor shall insert, at this point, a copy of the fully executed Certificate of Substantial Completion on the form incorporated in the project documents, as future reference for the Owner.
- E. CERTIFICATE OF STRUCTURES LOCATIONS: The Contractor shall have a state registered surveyor certify, in writing, with seal affixed, that the location of all new structure(s) and site improvements are in compliance with the Contract Documents and accurately recorded on the Contractor's As-Built Drawings.
- F. TESTING, INSPECTIONS AND CERTIFICATE OF OCCUPANCY: The Contractor shall provide copies of all test and balance reports from his Subcontractors as required. (See Division 21 thru 28 if provided.) Provide copies of all Certificates of Inspection from controlling authorities for each trade, division, or section of work, as required. Provide a copy of final executed Certificate of Occupancy.
- G. CONSENT OF SURETY: The Contractor and Contractors shall provide a Consent of Surety on A.I.A. Document G707, Latest Edition.

H. WARRANTY, GUARANTEE AND BONDS:

1. The Contractor and Subcontractors shall, and hereby does guarantee all Work and materials called for in the Contract Documents, including all work performed by the Contractor and his Subcontractors, for a minimum period of one (1) year from the date of Substantial Completion of the building, unless a longer Warranty/Guarantee time is specified by individual Sections.
2. Warranty, guarantee and bonds will be as stated in the Contractor's contract and as specified in the individual Specification Sections..

I. INSTRUCTION/OPERATION MANUALS AND KEYS:

1. Contractor shall provide all equipment diagrams, instruction/operation manuals, wiring diagrams, and pneumatic and/or electrical control diagrams as applicable for each working characteristic of mechanical, electrical, and special equipment furnished under this Contract, and submitted at Substantial Completion.
2. The Contractor and Subcontractors shall provide a competent and experienced person(s) thoroughly familiar with the work, for a reasonable period of time to instruct the Owner's personnel in operation and maintenance of equipment, materials, and control systems. This instruction shall include normal start-up, run, stop, and emergency operations, location and operation of all controls, alarms, and alarm systems.
3. Label turn-over all keys.

**K. MAINTENANCE MANUALS AND SPARE PARTS:**

(All items in this Section are required prior to issuance of Certificate of Substantial Completion.)

1. Contractor shall provide all instructions and maintenance manuals for products, mechanical, electrical, and special equipment. This instruction shall include tracing the system in the field and on the diagrams in the manuals so that maintenance personnel will be thoroughly familiar with both systems and the data supplied.
2. Contractor shall submit all parts lists, spare parts, tools, fuses, bulbs, and motor listing, containing locations, motor nameplate, rating, and size of overload relay installed.
3. Contractor shall also provide all maintenance letters as listed in the specifications for manufacturer's cleaning procedures, materials and equipment to be used, including instruction as listed above.

**J. AS-BUILT DRAWINGS:**

1. Final corrected "As-Built" or "Record" drawings shall be complete and accepted by the Architect/Engineer.
2. Refer to Article 3.11.1, Record Drawings, for specified process and requirements.

**ARTICLE 18: HISTORICAL AND ARCHAEOLOGICAL DATA PRESERVATION:**

- A. The Contractor agrees to facilitate the preservation and enhancement of structures and objects of historical, architectural or archaeological significance and when such items are found and/or unearthed during the course of project construction. Any excavation by the Contractor that uncovers an historical or archaeological artifact shall be immediately reported to the Owner and a representative of the Architect. Construction within the immediate area shall be temporarily halted pending the notification process and further directions issued by the Architect after consultation with the State Historic Preservation Officer (SHPO) for recovery of the items. See the National Historic Preservation Act of 1966 (80 Stat 915, 16 U.S.C. § 470) and Executive Order No. 11593 of May 31, 1971.

**ARTICLE 19 ENVIRONMENTAL REQUIREMENTS:**

- A. **Endangered Species.** The Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of the Contractor, the Contractor will immediately report this evidence to the Owner and a representative of the Architect. Construction within the affected area shall be temporarily halted pending the notification process and further directions issued by the Architect after consultation with the Florida Fish and Wildlife Conservation Commission.

**ARTICLE 20: INDEMNIFICATION:** To be as stated in the Contract between Owner and Contractor.

**END OF SECTION 00 82 00**



## SECTION 01 10 00 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary Conditions, Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Work under separate contracts.
5. Owner-furnished products.
6. Access to site.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and drawing conventions.

- B. Related Section:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Division 01 Section "Alternates" for cost of Work for specific items not included in Base-Bid amounts.

#### 1.3 PROJECT INFORMATION

- A. Project Identification and Owner:

BAY COUNTY, FL, BOARD OF COUNTY COMMISSIONERS  
BAY COUNTY EMERGENCY SERVICES JAIL  
SUBSTANCE ABUSE UNIT  
Bay County, Florida  
FLA Project No. 4223-07

- B. Project Location:

Bay County Emergency Services Criminal Jail  
5700 Star Lane  
Panama City, Florida 32404

- C. Architect:

FLORIDA ARCHITECTS, INC.  
103 W. 5<sup>th</sup> Street  
Panama City, FL 32401  
850.257.5400

- D. Project Website(s): Project Website(s) administered by the Architect will be used for purposes of managing communication and documents during the design and construction stages. The Contractor

shall register key personnel to access the internet based secure websites to administer the work with the Owner and Architect.

1. See Division 01 Section "Project Management and Coordination" for Contractor's requirements for utilizing the Project Website(s).

#### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of this contract involves construction on a section of property owned by Bay County Emergency Services Criminal Jail as identified in the contract documents. Major components of the project include:

1. New 12,000-SF facility adjacent to a fully occupied and operational Bay County Jail Facility.
2. The access connection to the existing Jail Facility shall be carefully coordinated with the Owner to prevent inmate escape.
3. Site Improvements.
4. Other requirements shown in the contract documents.
5. The work in this contract will NOT include a sustainable rating system or certification.

B. Type of Contract:

1. Project will be constructed under a single prime contract with a traditional Bid-Build General Contractor delivery method.
2. Owner's Standard Form of Agreement Between Owner and Contractor (Stipulated Sum) will be used for this project. Refer to Bid Documents Division 00.

#### 1.5 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

#### 1.6 OWNER-FURNISHED PRODUCTS

A. Owner DOES NOT plan to furnish products to be incorporated into the project at the time of the Contract. The Work would include receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections. The Contractor will participate in the Owner's Direct Purchase Tax Recovery Program as specified.

B. Owner-Furnished Products:

1. None (except Owner direct purchase tax recovery program)

#### 1.7 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section. Refer to the Architect's Site Plan for limits of construction (unless specifically noted otherwise), main and emergency construction temporary security fence and gates and access points, location of construction personnel parking, and the job-site office and meeting room portable building(s) location(s).

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated (unless specifically noted otherwise). Do not disturb portions of Project site beyond areas in which the Work is indicated without Owner's approval.

1. Limits: Limit site disturbance to the area of work required.

2. Construction fence and gates to be installed by the Contractor and removed at the completion of the work.
3. Driveways, Walkways and Entrances: Keep driveways loading areas, parking and entrances serving premises clear for emergency vehicles and Owner operations at all times. Do not use these areas for parking or storage of materials.
  - a. Schedule deliveries to minimize use of driveways, loading areas, and entrances by construction operations.
  - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

#### 1.8 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations. All contractor's employees will be subjected to a background check to work on the project.
  1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
- B. Controlled Substances: Use of tobacco products and other controlled substances in the building is NOT permitted.
- C. Employee Screening: Comply with Contractor's requirements regarding drug and background screening of personnel working on the Project site.

#### 1.9 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Conditions, and Division 01 General Requirements: Requirements of Sections in Divisions 00 and 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:
  1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and/or as scheduled on Drawings.
  3. Architectural Dictionary: A Concise Dictionary of Architectural Terms By John Henry Parker.

#### PART 2 - PRODUCTS (Not Used)

#### PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

## **SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General project coordination procedures.
  - 2. Administrative and supervisory personnel.
  - 3. Coordination Drawings.
  - 4. Requests for Information (RFIs).
  - 5. Project Website.
  - 6. Project Meetings.
- B. Related Sections:
  - 1. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 2. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

#### 1.3 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.
- B. ASI: Architect's Supplemental Instructions.
- C. RFP: Request for Proposal.

#### 1.4 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation. Prepare and submit Coordination Drawings.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals and Shop Drawings.
  - 5. Progress Meetings.
  - 6. Preinstallation Conferences.
  - 7. Project closeout activities.
  - 8. Startup, commissioning, and adjustment of systems.
  
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

## 1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare Coordination Drawings in accordance with requirements in individual Sections, and where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base Coordination Drawings solely on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of Coordination Drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    - e. Indicate required installation sequences.
    - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
  
- B. Coordination Drawing Organization: Organize Coordination Drawings as follows:
  - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
  - 2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
  - 3. Mechanical Rooms: Provide Coordination Drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
  - 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  - 5. Concrete Embedded Items: Indicate slab, columns and beam edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles,

door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Mechanical and Plumbing Work: Show the following:
  - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
  - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
  - c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
  - a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
  - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
  - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
  - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Review: Architect will review Coordination Drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Architect determines that the Coordination Drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Architect will so inform the Contractor, who shall make changes as directed and resubmit.
9. Coordination Drawing Prints: Prepare and submit coordination drawing files and prints in accordance with requirements of Division 01 Section "Submittal Procedures."

- C. Coordination Drawing Digital Data Files: Contractor's and Subcontractor's to prepare Shop Drawings, Coordination Drawings, and As-Built (Record) Drawings on ELECTRONIC MEDIA in Autodesk AutoCAD or Revit (2019 Version). Said Coordination Drawings shall be delivered to the Architect for review. Prepare Coordination Drawing digital data files in accordance with the following requirements:
  1. File Preparation Format: Same digital data software program, version, and operating system as the original Drawings.
  2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format and Autodesk AutoCAD or Revit (2019 Version) files.

## 1.6 KEY PERSONNEL

- A. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
  1. Post copies of list in project temporary field office, on Project Website, and by each temporary telephone. Keep list current at all times.

## 1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  1. Architect will return RFIs submitted to Architect to the Contractor with response within seven (7) working days.
  2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of Subcontractors.

- B. Frivolous RFIs:
1. RFIs submitted to the Architect, where the response is clearly obvious in the contract documents, shall be returned indicating only where the response may be located.
  2. The time involved in reviewing the documents to locate the response and the time required to prepare the response to frivolous RFI's shall be billed to the Contractor at the Project Architect's prevailing wage rate.
- C. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Architect.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.
  13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, Coordination Drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
    - b. Include items on drawings as original and add, modify and describe any additional items on the drawings that are to be installed.
- D. RFI Forms: [AIA Document G716].
- E. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect after 3:00 p.m., will be considered as received the following working day.
1. The following RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for coordination information already indicated in the Contract Documents.
    - c. Requests for adjustments in the Contract Time or the Contract Sum.
    - d. Requests for interpretation of Architect's actions on submittals.
    - e. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit a Change Proposal according to Division 01 Section "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Owner in writing within seven (7) days of receipt of the RFI response.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.



- G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Website or can be posted to the Project Website. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number including RFIs that were dropped and not submitted.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

## 1.8 PROJECT WEBSITE

- A. Use Architect's Project Website(s) for purposes of hosting and managing project communication and documentation until Final Completion. Project Website(s) shall include the following functions:
1. Project directory.
  2. Project correspondence.
  3. Meeting minutes.
  4. Contract modifications forms and logs.
  5. RFI and ASI forms and logs.
  6. Task and issue management.
  7. Photo documentation.
  8. Schedule and calendar management.
  9. Submittals, Shop Drawings forms and logs.
  10. Coordination Drawings.
  11. Payment application forms.
  12. Drawing and specification document hosting, viewing, and updating.
  13. Online document collaboration.
  14. Reminder and tracking functions.
  15. Archiving functions.
- B. Upon completion of Project, provide one complete archive copy of Project Website files to Owner and to Architect in a digital storage format acceptable to the Architect.
- C. The Architect will provide access to the following Project Website software package under their current published licensing agreements:
1. BaseCamp by 37 Signals.
- D. Contractor and other parties granted access by the Contractor to project Websites shall execute a data licensing agreement/digital file release in the form of Agreement included in this Project Manual.

## 1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Contractor responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting via BaseCamp. Bay County shall record monthly progress meetings.

- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect.
1. Conduct the conference to review responsibilities and personnel assignments.
  2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Critical work sequencing and long-lead items.
    - c. Designation of key personnel and their duties.
    - d. Lines of communications.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFIs.
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Distribution of the Contract Documents.
    - j. Submittal procedures.
    - k. Preparation of record documents.
    - l. Use of the premises and existing building.
    - m. Work restrictions.
    - n. Working hours.
    - o. Owner's occupancy requirements.
    - p. Responsibility for temporary facilities and controls.
    - q. Procedures for moisture and mold control.
    - r. Procedures for disruptions and shutdowns.
    - s. Construction waste management and recycling.
    - t. Parking availability.
    - u. Office, work, and storage areas.
    - v. Equipment deliveries and priorities.
    - w. First aid.
    - x. Security.
    - y. Progress cleaning.
  4. Minutes: Contractor responsible for conducting meeting will record and distribute meeting minutes via BaseCamp.
- C. Preinstallation Conferences: Conduct a Preinstallation Conference at Project site before each construction activity that requires coordination with other construction, and as specified in individual Sections of the Specifications.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Owner, and Owner's Commissioning Authority, the Contractor, Subcontractor(s), supplier(s), and other concerned entities of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Review of mockups.
    - h. Possible conflicts.
    - i. Compatibility problems.
    - j. Time schedules.

- k. Weather limitations.
  - l. Manufacturer's written recommendations.
  - m. Warranty requirements.
  - n. Compatibility of materials.
  - o. Acceptability of substrates.
  - p. Temporary facilities and controls.
  - q. Space and access limitations.
  - r. Regulations of authorities having jurisdiction.
  - s. Testing and inspecting requirements.
  - t. Installation procedures.
  - u. Coordination with other work.
  - v. Required performance results.
  - w. Protection of adjacent work.
  - x. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Monthly Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
  2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, the Contractor, Subcontractor(s), supplier(s), and other entities concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals including GBI Green Globes requirements.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - 8) Temporary facilities and controls.
      - 9) Progress cleaning.
      - 10) Quality and work standards.
      - 11) Status of correction of deficient items.
      - 12) Field observations.
      - 13) Status of RFIs.
      - 14) Status of proposal requests.
      - 15) Pending changes.

- 16) Status of Change Orders.
  - 17) Pending claims and disputes.
  - 18) Documentation of information for payment requests.
4. Minutes: Contractor responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information via BaseCamp.
- a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting via BaseCamp.
  - b.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

## SECTION 01 33 00 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections:
  - 1. Division 00 Section "Conditions of the Contract" for submitting Applications for Payment and the schedule of values.
  - 2. Division 01 Section "Project Management & Coordination" for submitting schedules and reports, including Contractor's construction schedule, and coordination drawings.
  - 3. Division 01 Section "Close-Out Documents" for submitting operation and maintenance manuals.

#### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.
- E. Digital Drawing Files: Autodesk Architectural Desktop AutoCAD (.dwg) or Revit (rvt.) 2019.

#### 1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 30 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
  - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
  - a. Scheduled date for first submittal.
  - b. Specification Section number and title.
  - c. Submittal category: Action, informational.
  - d. Name of subcontractor.
  - e. Description of the Work covered.
  - f. Scheduled date for Architect's final release or approval.
  - g. Scheduled dates for purchasing.
  - h. Scheduled dates for installation.
  - i. Activity or event number.

#### 1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. ELECTRONIC MEDIA on Portable Document Format (PDF): The Architect will provide the Contractor with the selected digital PDF files of the building and site for the Contractor's and Subcontractor's use.
  1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings, Coordination Drawings, and As-Built Drawings.
    - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the actual in-place construction. Contractor shall field verify in-place construction dimensions.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities and submittals.
  1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. Initial Review: Allow 7 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 7 days for review of each resubmittal.
  4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 10 days for initial review of each submittal.
- D. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Include the following information for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Name of Subcontractor.
    - f. Name of Supplier.
    - g. Name of Manufacturer.
    - h. Submittal number or other unique identifier, including revision identifier.
      - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
    - i. Number and title of appropriate Specification Section.
    - j. Drawing number and detail references, as appropriate.
    - k. Location(s) where product is to be installed, as appropriate.
    - l. Other necessary identification.
- E. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
  3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
  4. Include the following information on an inserted cover sheet:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect.
    - d. Name of Contractor.
    - e. Name of firm or entity that prepared submittal.
    - f. Name of subcontractor.
    - g. Name of supplier.
    - h. Name of manufacturer.
    - i. Number and title of appropriate Specification Section.
    - j. Drawing number and detail references, as appropriate.
    - k. Location(s) where product is to be installed, as appropriate.
    - l. Related physical samples submitted directly.
    - m. Other necessary identification.
  5. Include the following information as keywords in the electronic file metadata:
    - a. Project name.
    - b. Number and title of appropriate Specification Section.
    - c. Manufacturer name.
    - d. Product name.
- F. Options: Identify options requiring selection by the Architect.
- G. Deviations: Identify deviations from the Contract Documents on submittals.
- H. Additional Paper Copies: Unless additional signed originals are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one digital PDF file of submittal to concurrent reviewer in addition to specified number of copies to Architect, and in the absence of specified number, submit two paper copies for Owner.
- I. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using the specified transmittal form. Architect will discard submittals received from sources other than Contractor.
  1. Transmittal Form: Use attached Form.
  2. Transmittal Form: Provide locations on form for the following information:
    - a. Project name.
    - b. Date.
    - c. Destination (To:).
    - d. Source (From:).
    - e. Names of subcontractor, manufacturer, and supplier.
    - f. Category and type of submittal.
    - g. Submittal purpose and description.
    - h. Specification Section number and title.
    - i. Indication of full or partial submittal.
    - j. Drawing number and detail references, as appropriate.
    - k. Transmittal number, numbered consecutively.
    - l. Submittal and transmittal distribution record.
    - m. Remarks.
    - n. Signature of transmitter.
  3. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- L. Use for Construction: Use only final submittals that are marked with reviewed notation from Architect's action stamp.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  1. Post electronic submittals as PDF electronic files directly to Project Website specifically established for Project.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  2. Action Submittals: Post electronic submittals as PDF electronic files directly to Project Website.
  3. Informational Submittals: Post electronic submittals as PDF electronic files directly to Project Website.
  4. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."



5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
  6. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements" and in individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not alone suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before or concurrent with Samples.
  6. Submit Product Data in the following format:
    - a. PDF electronic file uploaded to the Architect's Project Website.
    - b. Architect will post action taken to the Project Website.
    - c. Submit one paper copy for Owner.
- C. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings solely on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.

3. Submit Shop Drawings in the following format:
  - a. PDF electronic file uploaded to the Architect's Project Website.
  - b. Architect will post action taken to the Project Website.
  
- E. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
  3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
  5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project record sample.
      - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
  
- F. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  1. Type of product. Include unique identifier for each product.
  2. Manufacturer and product name, and model number if applicable.
  3. Number and name of room or space.
  4. Location within room or space.
  5. Submit product schedule in the following format:
    - a. PDF electronic file uploaded to the Architect's Project Website.

- G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- H. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- I. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.
  4. Submit subcontract list in the following format:
    - a. PDF electronic file uploaded to the Architect's Project Website.
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.
- M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- R. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
  2. Date of evaluation.
  3. Time period when report is in effect.
  4. Product and manufacturers' names.
  5. Description of product.
  6. Test procedures and results.
  7. Limitations of use.
- T. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

- W. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## 2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with Contractor's approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and post it to the Project Website. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party via BaseCamp.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

- E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned or posted as rejected without review.
- F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
- G. Submittals are required to be uploaded to the Architect's project website will be stamped reviewed and posted on the Architect's project website.

END OF SECTION 01 33 00

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**SECTION 01 33 20 - ROUTING TRANSMITTAL**

**CONTRACTOR:** \_\_\_\_\_ ARCHITECT FLORIDA ARCHITECTS, INC.  
Panama City, Florida 32401

**SPEC. SECTION NO.** \_\_\_\_\_ FLA Project No. 4325-01

**ITEM** \_\_\_\_\_ Project Name \_\_\_\_\_

SUB-CONTRACTOR / SUPPLIER \_\_\_\_\_ OWNER \_\_\_\_\_

\_\_\_\_\_ VARIANCE ATTACHED YES \_\_\_\_\_ NO \_\_\_\_\_

**DATE SENT** \_\_\_\_\_ **NO. COPIES** \_\_\_\_\_

103 W. 5<sup>th</sup> Street

DATE RECEIVED \_\_\_\_\_

**FLA to CONSULTANT** \_\_\_\_\_ DATE RECEIVED BY CONSULTANT \_\_\_\_\_

**DATE SENT** \_\_\_\_\_ **NO. COPIES** \_\_\_\_\_

CONSULTANT \_\_\_\_\_

ATTN: \_\_\_\_\_

**CONSULTANT to FLA** \_\_\_\_\_ DATE RECEIVED BY D/PR \_\_\_\_\_

**DATE SENT** \_\_\_\_\_ **NO. COPIES** \_\_\_\_\_

REVIEWED BY \_\_\_\_\_

COMMENTS \_\_\_\_\_

**FLA to CONTRACTOR** \_\_\_\_\_ DATE RECEIVED BY CONTRACTOR \_\_\_\_\_

**DATE SENT** \_\_\_\_\_

TO CONTRACTOR \_\_\_\_\_

AGENCY \_\_\_\_\_ OWNER \_\_\_\_\_ FILE \_\_\_\_\_

**ACTION TAKEN:**

- \_\_\_\_\_ Rejected
- \_\_\_\_\_ Revise and Resubmit as Noted
- \_\_\_\_\_ Conforms with Design Concept as Noted
- \_\_\_\_\_ Conforms with Design Concept
- \_\_\_\_\_ Submit Corrected Copy
- \_\_\_\_\_ No Action Taken

END OF SECTION 01 33 20



## SECTION 01 40 00 - QUALITY REQUIREMENTS

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.
  - 3. Specific test and inspection requirements are not specified in this Section.

### 1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

### 1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
  - 1. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan. This includes all steel to steel connections, steel bracing, etc.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

### 1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.

3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
  
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to **ASTM E 329**; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
  
- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
  
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
  - 1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - d. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
  - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

## 1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
  - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
  
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least **24** hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. **Manufacturer's Field Services:** Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- D. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. **Testing Agency Responsibilities:** Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- F. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.

- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

- 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## 1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: **Owner will engage** a qualified **testing agency and special inspector** to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, **as indicated in Statement of Special Inspections attached to this Section**, and as follows:

- B. Special Tests and Inspections: Conducted by a qualified **testing agency and special inspector** as required by authorities having jurisdiction, as indicated in individual Specification Sections **and in Statement of Special Inspections attached to this Section**, and as follows:

- 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
  - 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
  - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  - 6. Retesting and reinspecting corrected work.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
  - 1. Date test or inspection was conducted.
  - 2. Description of the Work tested or inspected.
  - 3. Date test or inspection results were transmitted to Architect.
  - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

## SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes requirements for temporary fencing, utilities, support facilities, and security and protection facilities.
- B. Related Sections:
  - 1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.
  - 2. Division 31 Section "Dewatering" for disposal of ground water at Project site.
  - 3. Division 32 Section "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

#### 1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Owner will pay sewer service use charges for sewer usage by all entities for construction operations.
- C. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations. Temporary services are not permitted to encroach Owner occupied areas at any time. Contractor may make provisions for other water source(s) as necessary at his expense.
- D. Electric Power Service: The Contractor shall coordinate and pay for permit, installation, and operation of temporary electrical power service. The Contractor shall make provisions to allow all Subcontractors access to electrical power needs for construction.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.
  - 1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.



- D. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
1. Locations of dust-control partitions at each phase of the work.
  2. HVAC system isolation schematic drawing.
  3. Other dust-control measures.
  4. Waste management plan.
- E. Hurricane Preparedness Plan: Submit narrative that describes the Hurricane Preparedness Plan, policies, procedures, resources and implementation.
- F. Cold Weather Protection Plan: Submit narrative that describes the Cold Weather Protection Plan, policies, procedures, resources, materials and implementation. Also refer to Section 03 33 00, Cast-In-Place Concrete and Section 04 20 00, Unit Masonry, and Section 04 26 13, Masonry Veneer.

## 1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange and pay for for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and FBC/ANSI A117.1.

## 1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch , 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.
- B. Portable Chain-Link Fencing: Minimum 2-inch , 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized steel bases for supporting posts.
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.

### 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
  2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
  3. Coffee machine and coffee supplies.
  4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F .
  5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
  6. Anchor to resist design wind loads.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Store combustible materials apart from building.
  2. Anchor to resist design wind loads.

### 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section "Closeout Procedures".

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
  2. Also refer to Architect's Site Plan for additional information.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system or private system indicated as directed by authorities having jurisdiction.
- C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
  1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- G. Electric Power Service: Connect to existing electric power service in existing building for the remodeling work in that building. Provide new temporary service for the new construction work. Maintain equipment in a condition acceptable to authorities having jurisdiction and the Owner.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
  2. Install lighting for Project identification sign.
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office or dedicate mobile telephones.
  1. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's home office.
    - d. Architect's office.
    - e. Engineers' offices.
    - f. Owner's office.
    - g. Principal subcontractors' field and home offices.
  2. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- J. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications. Additional equipment as follows:
  1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these 3 functions.
  2. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
  3. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing and spam protection in a combined application.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
  2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  2. Maintain access for fire-fighting equipment and access to fire hydrants.
  3. Maintain access for bus loading operations.
- D. Parking: Provide temporary parking areas for construction personnel where designated by Owner and as may be shown on the Architect's Site Plan.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
  2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated herein. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
  2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    - a. Provide temporary, directional signs for construction personnel and visitors.
  3. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Temporary Elevator Use (if required): Refer to Division 14 Sections for temporary use of new elevators.
- J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Division 01 Section "Summary."

- B. Temporary Erosion and Sedimentation Control: Comply with requirements of authorities having jurisdiction, and requirements specified in Division 31 Section "Site Clearing."
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Tree and Plant Protection: Comply with requirements specified in Division 01 Section "Temporary Tree and Plant Protection."
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
  - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations and as approved by Owner.
  - 2. Refer to Architect's Site Plan for construction fence and gates locations.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

### 3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction. Do not expose finish materials to moisture and humidity.
- B. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
  - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building or in a space with humidity and temperature control.
  - 2. Keep interior spaces reasonably clean and protected from water damage.
  - 3. Discard or replace water-damaged material.
  - 4. Do not install material that is wet.
  - 5. Discard, replace or clean stored or installed material that begins to grow mold.
  - 6. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

### 3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of

interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01 50 00

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**SECTION 01 50 10a – PROJECT SIGN COVER PAGE**

See Attached Documents

END OF SECTION 01 50 10



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## **SECTION 01 73 00 - EXECUTION**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. General installation of products.
  - 4. Coordination of Owner-installed products.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
  - 8. Correction of the Work.
- B. Related Sections include the following:
  - 1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
  - 2. Division 01 Section "Submittal Procedures" for submitting surveys.
  - 3. Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
  - 4. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

#### 1.3 SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- D. Certified Surveys: Submit two copies signed and sealed by land surveyor.

#### 1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 3. Inform installers of lines and levels to which they must comply.
  - 4. Check the location, level and plumb, of every major element as the Work progresses.
  - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### 3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and Sitework for each building within the project.

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  4. Maintain minimum headroom clearance of 10 feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 PROGRESS CLEANING

- A. General: **Clean Project site and work areas daily**, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F .
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."
- E. Refer to other Sections of the Specifications for Commissioning.

### 3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### 3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

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## **SECTION 01 73 29 - CUTTING AND PATCHING**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
  - 1. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
  - 2. Division 07 Section "Penetration Firestopping" for patching fire-rated construction.

#### 1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

#### 1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
  - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
  - 3. Products: List products to be used and firms or entities that will perform the Work.
  - 4. Dates: Indicate when cutting and patching will be performed.
  - 5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
  - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
  - 7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

#### 1.5 QUALITY ASSURANCE



- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
  - 1. Primary operational systems and equipment.
  - 2. Air or smoke barriers.
  - 3. Fire-suppression systems.
  - 4. Mechanical systems piping and ducts.
  - 5. Control systems.
  - 6. Communication systems.
  - 7. Conveying systems.
  - 8. Electrical wiring systems.
  - 9. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
  - 1. Water, moisture, or vapor barriers.
  - 2. Membranes and flashings.
  - 3. Exterior curtain-wall construction.
  - 4. Equipment supports.
  - 5. Piping, ductwork, vessels, and equipment.
  - 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

### 3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
  1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or re-hang in place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

## SECTION 01 77 00 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Inspection procedures.
  2. Warranties.
  3. Final cleaning.
- B. Related Sections include the following:
1. Division 01 Section "Execution" for progress cleaning of Project site.
  2. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  4. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

#### 1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  2. Advise Owner of pending insurance changeover requirements.
  3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
  6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  8. Complete startup testing of systems.
  9. Complete commissioning.
  10. Submit test/adjust/balance records.
  11. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  12. Advise Owner of changeover in HVAC and other utilities.
  13. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

14. Complete final cleaning requirements, including touchup painting.
15. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

#### 1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect and Owner. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit As-Built Drawings.
4. Submit Close-Out documentation.
5. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
6. Submit pest-control final inspection report and warranty.
7. Submit sustainable design GBI Green Globes Certification information.
8. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
  - a. Project name.
  - b. Date.
  - c. Name of Architect.
  - d. Name of Contractor.
  - e. Page number.

## 1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period or by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - g. Sweep concrete floors broom clean in unoccupied spaces.

- h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
  - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - j. Remove labels that are not permanent.
  - k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - m. Replace parts subject to unusual operating conditions.
  - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - p. Clean ducts, blowers, and coils if units were operated without filters during construction.
  - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
  - r. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00

## **SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Operation manuals for systems, subsystems, and equipment.
  - 3. Maintenance manuals for the care and maintenance of products, materials, finishes, systems and equipment.
- B. Related Sections include the following:
  - 1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
  - 3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
  - 4. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

#### 1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

#### 1.4 SUBMITTALS

- A. Initial Submittal: Submit digital (PDF) draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.
- B. Final Submittal: Submit one printed (3-ring binder) and one (1) digital (PDF) file copy posted to Architect's Project Website of each manual for each building in final form at least 10 days before final inspection. Architect will return post with comments within 5 days after final inspection.
  - 1. Correct or modify each manual to comply with Architect's comments. Submit 1 printed copy of each corrected manual (in 3-ring binder) within 10 days of receipt of Architect's comments and one (1) digital (PDF) file copy posted to Architect's Project Website of each manual.

#### 1.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.



## PART 2 - PRODUCTS

### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
  - 1. List of documents.
  - 2. List of systems.
  - 3. List of equipment.
  - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

### 2.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name, address, and telephone number of Contractor.
  - 6. Name and address of Architect.
  - 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
  - 1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  1. System, subsystem, and equipment descriptions.
  2. Performance and design criteria if Contractor is delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
  1. Product name and model number.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
  1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.
  4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.4 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## 2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard printed maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training videotape, if available.

- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

### PART 3 - EXECUTION

#### 3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."
- G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

**SECTION 02 32 00a – GEOTECHNICAL RECOMMENDATIONS COVER PAGE**

See Attached Report

END OF SECTION 02 32 00

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# GEOTECHNICAL ENGINEERING REPORT



## Bay County Jail Substance Abuse Facility Panama City, Bay County, Florida

**PREPARED FOR:**  
Bay County - Public Works Division  
840 West 11<sup>th</sup> Street  
Panama City, Florida 32401

NOVA Project Number: 10111-2023053

May 9, 2023







May 9, 2023

**Bay County - Public Works Division**  
840 West 11<sup>th</sup> Street  
Panama City, Florida 32401

**Attention:** Mr. Fred Brown

**Subject:** Geotechnical Engineering Report  
**Bay County Jail Substance Abuse Facility**  
Panama City, Bay County, Florida  
NOVA Project Number 10111-2023053

Dear Mr. Brown,

NOVA Engineering and Environmental LLC (NOVA) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the proposed Bay County Jail Substance Abuse Facility to be constructed in Panama City, Bay County, Florida. The work was performed in general accordance with NOVA proposal number 011-20238597, dated March 21, 2023. This report briefly discusses our understanding of the project at the time of the subsurface exploration, describes the geotechnical consulting services provided by NOVA, and presents our findings, conclusions, and recommendations.

We appreciate your selection of NOVA and the opportunity to be of service on this project. If you have any questions, or if we may be of further assistance, please do not hesitate to contact us.

Sincerely,  
NOVA ENGINEERING AND ENVIRONMENTAL LLC

K. Nick Gonzalez  
Staff Engineer



William L. Lawrence, P.E.  
Principal Engineer  
Florida Registration No. 60147

*Copies Submitted: Addressee (electronic)*

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## APPENDICES

- APPENDIX A – FIGURES & MAPS
- APPENDIX B – SUBSURFACE DATA
- APPENDIX C – LABORATORY DATA
- APPENDIX D – SUPPORT DOCUMENTS

## 1.0 SUMMARY

A brief summary of pertinent findings, conclusions and recommendations is presented below. This information should not be utilized in design or construction without reading all of the recommendations presented in the text and Appendix of this report.

### 1.1 GENERAL

Our field exploration at the subject site consisted of performing six (6) Standard Penetration Test (SPT) borings within the proposed structure footprint. Drilling, testing, and sampling operations were performed in general accordance with ASTM designations and other industry standards.

The test borings generally encountered mixed strata of loose to medium dense fine-grained sands to clayey sands (USCS classifications of SP, SP-SM, SP-SC and SC) from the existing ground surface elevation to a depth of approximately 12 feet below existing grade (BEG) underlain by soft clay (CL) to roughly 16 to 18 feet BEG, in turn underlain by loose to medium dense fine-grained clayey sand (SC) to the maximum depth explored of about 25 feet BEG.

### 1.2 SITE PREPARATION

We recommend removing the existing structures and substructures scheduled for demolition as part of this project as well as all topsoil and surficial vegetation, associated root systems, and any other deleterious non-soil materials that are found to be present from within the proposed building footprint. We recommend that the exposed subgrade soils at the stripped elevation, as well as subsequent lifts of backfill and fill soils, be compacted via non-vibratory methods to a minimum soil density of at least 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557). The top 12 inches of subgrade in all footing excavations should be compacted to at least 98 percent.

Vibratory compaction of the subgrade soils using a heavy-weight steel drum roller is not recommended for this project due to the very close proximity of an existing structure. Compaction of excavated footings should be accomplished using self-propelled sled tamps or jumping jacks.

A geotechnical engineer should also carefully evaluate all subgrades prior to foundation and slab-on-grade construction to confirm compliance with this report; evaluate geotechnical sections of the plans and specifications for the overall project; and provide additional recommendations that may be required.

### 1.3 GROUNDWATER CONTROL

Groundwater was encountered in the test borings at depths varying between about 3 feet to 4½ feet BEG at the time of our subsurface exploration, which occurred during a period of relatively normal seasonal rainfall. Depending on the time of construction, groundwater could potentially impact the planned near surface construction, most probably (depending on fill heights) during shallow foundation and subsurface utility installations. Contractors should be prepared to utilize a dewatering system during construction to maintain separation between the groundwater levels and the desired working platforms for below-grade work.

### 1.4 FOUNDATION RECOMMENDATIONS

After the recommended site/subgrade preparation and fill placement, we recommend that the proposed structure be supported on a conventional shallow foundation system bearing upon compacted native soils and/or compacted structural fill as recommended above. The building foundation may be designed employing a maximum allowable soil bearing pressure of **2,500 pounds per square foot (psf)**.

We note that an approximately 4-foot thick stratum of soft clay was encountered in the test borings beginning at a depth of about 12 feet BEG. Our settlement analysis for this structure was based on an assumption of a maximum fill height of 1 foot above existing site grade elevations within the proposed structure footprint being necessary to achieve the desired finished floor elevation for the proposed structure, as well as assumptions of maximum isolated column and continuous load bearing wall loads of 50 kips per column and 4 kips per linear foot, respectively. **Should actual fill heights or assumed loadings exceed the values stated above, NOVA should be notified to determine if the zone of influence from the increased loading might encroach into this soft clay zone, thereby driving settlements above tolerable limits.**

## 2.0 INTRODUCTION

### 2.1 PROJECT INFORMATION

Our understanding of the proposed development is based on recent conversations and email exchanges with the Client, review of aerial photography of the site via internet-based GIS software, and our experience with similar geotechnical conditions in the near vicinity to this project site.

#### 2.1.1 Proposed Construction

NOVA understands the project will include the construction of a new single-story building with a planned footprint of approximately 12,000 square feet. We anticipate that the structure will be of concrete masonry unit (CMU) construction supported by a conventional shallow foundation system. Structural loadings were not available from the design team at the time of the issuance of this report. We have therefore assumed that isolated interior column and continuous load bearing wall loads will not exceed 50 kips per column and 4 kips per linear foot, respectively.

#### 2.1.2 Site Grading

Final site grading details were not available from the design team at the time of the issuance of this report; we have therefore assumed that finished grade elevations will closely match (i.e., be within 1 foot of) existing grade elevations within the proposed structure footprint.

### 2.2 SCOPE OF WORK

**Bay County - Public Works Division** engaged NOVA to provide geotechnical engineering consulting services for the proposed project. This report briefly discusses our understanding of the project, describes our exploratory procedures, and presents our findings, conclusions, and recommendations.

The primary objectives of this study were to perform a geotechnical exploration within the proposed building footprint and to assess these findings as they relate to geotechnical aspects of the planned site improvements. The authorized geotechnical engineering services included a soil test boring and sampling program, laboratory testing, engineering evaluation of the field and laboratory data, and the preparation of this report. The services were performed substantially as outlined in our proposal number 011-20238597, dated March 21, 2023, and in general accordance with industry standards.

As authorized per the above referenced proposal, this completed geotechnical report includes:

- A description of the site, fieldwork, laboratory testing, and general soil conditions encountered, together with a Boring Location Plan and individual Test Boring Records.
- Site preparation considerations that include geotechnical discussions regarding site stripping and subgrade preparation and engineered fill/backfill placement.
- Recommendations for controlling groundwater and/or run-off during construction, and the potential need for a permanent dewatering system based on the anticipated post construction groundwater levels.
- Shallow foundation system recommendations for the proposed structure.
- Slab-on-grade construction considerations based on the geotechnical findings, including the need for a sub-slab vapor barrier or a capillary barrier.
- Suitability of on-site soils for re-use as structural fill and backfill. Additionally, the criteria for suitable fill materials will be provided.
- Recommended quality control measures (i.e., sampling, testing, and inspection requirements) for site grading and foundation construction.

The assessment of site environmental conditions, including the presence of wetlands or detection of pollutants in the soil, rock or groundwater, laboratory testing of samples, or a site-specific seismic study was beyond the scope of this geotechnical study. If requested, NOVA can provide these services.

## 3.0 SITE DESCRIPTION

### 3.1 LOCATION AND LEGAL DESCRIPTION

The Bay County Sheriff's Office Jail facility is located at 5700 Star Lane in Panama City, Bay County, Florida. The area of study is located in the southwestern corner of the overall facility's grounds, just outside the existing perimeter security fence and at the current location of a structure that will be demolished as part of this project.

## 4.0 FIELD AND LABORATORY PROCEDURES

### 4.1 FIELD EXPLORATION

The boring locations were established in the field by NOVA personnel by using a hand-held GPS unit. Consequently, referenced boring locations should be considered approximate. If the Client desires increased accuracy, NOVA recommends that the boring locations and elevations be surveyed. Our field exploration included performing:

- Six 25-foot deep Standard Penetration Test (SPT) borings within the proposed structure footprint.

**SPT Borings:** The Standard Penetration Test borings were performed using the guidelines of ASTM Designation D-1586, "Penetration Test and Split-Barrel Sampling of Soils". A mud rotary drilling process was used to advance the borings. At regular intervals, soil samples were obtained with a standard 1.4-inch I.D., 2.0-inch O.D., split-tube sampler. The sampler was first seated six inches and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance". The penetration resistance, when properly interpreted, is an index to the soil strength and density. Representative portions of the soil samples, obtained from the sampler, were placed in sealed containers and transported to our laboratory for further evaluation and laboratory testing.

**Groundwater Levels:** The groundwater levels reported on the Test Boring Records represent measurements made at the completion of each test boring, following a suitable stabilization period. The test borings were subsequently backfilled with soil cuttings from the drilling process for safety concerns.

### 4.2 LABORATORY TESTING

A laboratory testing program was conducted to characterize materials existing at the site using split spoon samples recovered from the borings. The laboratory test data are presented in the Appendix, and select test data are also presented on the Test Boring Records. The specific tests are briefly described below. All soil samples will be properly disposed of 30 days following the submittal of this NOVA subsurface exploration report unless you request otherwise.

#### 4.2.1 Soil Classification

Soil classification provides a general guide to the engineering properties of various soil types and enable the engineer to apply past experience to current problems. In our explorations, samples obtained during drilling operations are

observed in our laboratory and visually classified by an engineer. The soils are classified according to relative density (based on SPT N-values), color and texture. These classification descriptions are included on our Test Boring Records. The classification system discussed above is primarily qualitative; laboratory testing is generally required for detailed soil classification. Using the test results, the soils were visually/manually classified according to the Unified Soil Classification System. This classification system and the in-place physical soil properties provide an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented in this report.

#### **4.2.2 Moisture Content**

The moisture content is the ratio expressed as a percentage of the weight of water in a given mass of soil to the weight of the solid particles. This testing was conducted in general accordance with ASTM Designation D-2216. Seven moisture content tests were performed in this study.

#### **4.2.3 Fines Content**

The percentage of fines passing through the No. 200 sieve is generally considered to represent the amount of silt and clay of the tested soil sample. The sieve analysis testing was conducted in general accordance with ASTM Designations D-6913 and D-1140. Six fines content tests were performed in this study.

#### **4.2.4 Atterberg Limit Testing**

The Atterberg Limits are different descriptions of the moisture content of fine-grained soils as it transitions between a solid to a liquid-state. For classification purposes the two primary Atterberg Limits used are the plastic limit (PL) and the liquid limit (LL). The plasticity index (PI) is also calculated for soil classification. The plastic limit (PL) is the moisture content at which a soil transitions from being in a semisolid state to a plastic state. The liquid limit (LL) is defined as the moisture content at which a soil transitions from a plastic state to a liquid state. One Atterberg Limits test was performed in this study, in general accordance with ASTM D-4318.



## 5.0 SUBSURFACE CONDITIONS

### 5.1 GEOLOGY

According to the United States Geological Survey (USGS), the subject site is located in Bay County within the Gulf Coastal Plain, separated from the Florida Platform by geologic structures known as the Gulf Trough and Apalachicola Embayment. These structures formed a bathymetric and environmental barrier from the earliest Eocene or earliest Oligocene periods into the Miocene. According to the "Text to Accompany the Geologic Map of Florida" by Scott, 2001, the site is generally underlain by undifferentiated sediments deposited during the Quaternary period. These sediments typically consist of siliciclastics (sand), organics and freshwater carbonates. These soils are highly permeable and form the Sand and Gravel Aquifer of the surficial aquifer system. Surficial soils in the region are primarily siliciclastic sediments deposited in response to the renewed uplift and erosion in the Appalachian highlands to the north and sea-level fluctuations. The extent and type of deposit is influenced by numerous factors, including mineral composition of the parent rock and meteorological events.

### 5.2 SOIL CONDITIONS

The following paragraph provides a generalized description of the subsurface profile and soil conditions encountered by the borings. The Test Boring Records provided in the Appendix should be reviewed to provide more detailed descriptions of the subsurface conditions encountered at the boring locations. Conditions may vary at other locations and times.

The test borings generally encountered mixed strata of loose to medium dense fine-grained sands to clayey sands (USCS classifications of SP, SP-SM, SP-SC and SC) from the existing ground surface elevation to a depth of approximately 12 feet below existing grade (BEG) underlain by soft clay (CL) to roughly 16 to 18 feet BEG, in turn underlain by loose to medium dense fine-grained clayey sand (SC) to the maximum depth explored of about 25 feet BEG.

### 5.3 GROUNDWATER CONDITIONS

#### 5.3.1 General

Groundwater in the Gulf Coastal Plain typically occurs as an unconfined aquifer condition. Recharge is provided by the infiltration of rainfall and surface water through the soil overburden. More permeable zones in the soil matrix can affect groundwater conditions. The groundwater table is expected to be a subdued replica of the original surface topography.

### **5.3.2 Soil Test Boring Groundwater Conditions**

Groundwater was encountered in the test borings at depths varying between about 3 feet to 4½ feet BEG at the time of our subsurface exploration, which occurred during a period of relatively normal seasonal rainfall.

Based on our review of the subsurface conditions encountered in the test borings, we estimate that the normal permanent seasonal high groundwater (SHGW) table will occur within about 1 foot above the groundwater levels measured at the boring locations during our field exploration.

Groundwater levels vary with changes in season and rainfall, construction activity, surface water runoff and other site-specific factors. Groundwater levels in the Bay County area are typically lowest in the late spring and the late fall and highest in the summer with annual groundwater fluctuations by seasonal rainfall; consequently, the water table may vary at times.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on our understanding of the proposed construction, our site observations, our evaluation and interpretation of the field and laboratory data obtained during this exploration, our experience with similar subsurface conditions, and generally accepted geotechnical engineering principles and practices.

Subsurface conditions in unexplored locations or at other times may vary from those encountered at specific boring locations. If such variations are noted during construction, or if project development plans are changed, we request the opportunity to review the changes and amend our recommendations, if necessary.

As was previously noted, the boring locations were established in the field by NOVA personnel by using a hand-held GPS unit. If increased accuracy is desired by the Client, we recommend that the boring locations and elevations be surveyed.

### 6.1 SITE PREPARATION AND GRADING

We recommend removing the existing structures and substructures scheduled for demolition as part of this project as well as all topsoil and surficial vegetation, associated root systems, and any other deleterious non-soil materials that are found to be present from within the proposed building footprint. We recommend that the exposed subgrade soils at the stripped grade elevation be compacted via non-vibratory methods to a minimum soil density of at least 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

Vibratory compaction of the subgrade soils using a heavy-weight steel drum roller is not recommended for this project due to the very close proximity of an existing structure. Compaction of excavated footings should be accomplished using self-propelled sled tamps or jumping jacks.

A geotechnical engineer should also carefully evaluate all subgrades prior to foundation and slab-on-grade construction to confirm compliance with this report; evaluate geotechnical sections of the plans and specifications for the overall project; and provide additional recommendations that may be required.

### 6.2 FILL PLACEMENT

#### 6.2.1 Fill Suitability

Fill materials should be relatively clean sands with less than 12 percent fines (material passing the No. 200 sieve), and free of non-soil materials and rock fragments larger than 3 inches in diameter. Based on results of the test borings, on-site near surface soils that are categorized as clayey fine-grained sands (SC)

with fines contents between 12 and 25 percent based on the Unified Soil Classification System (USCS) are also considered suitable for the use of structural fill in the proposed building, provided that the materials are free of rubble, clay, rock, roots, and organics. We note, however, that strict moisture control would be required at the time of placement for these moisture-sensitive soils. Soils with fines contents in excess of 25 percent are not suitable for reuse.

All materials to be used for backfill or compacted fill construction should be evaluated and, if necessary, tested by NOVA prior to placement to determine if they are suitable for their intended use. Any off-site materials used as fill should be approved by NOVA prior to acquisition.

### **6.2.2 Soil Compaction**

Fill should be placed in thin, horizontal loose lifts (maximum 12-inch thickness) and compacted via non-vibratory methods to a minimum soil density of at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). The upper 12 inches of soil beneath the bottoms of all shallow foundation footings should be compacted to at least 98 percent.

In confined areas, such as utility trenches, portable compaction equipment and thinner fill lifts (3 to 4 inches) may be necessary. Fill materials used in structural areas should have a target maximum dry density of at least 100 pounds per cubic foot (pcf). If lighter weight fill materials are used, the NOVA geotechnical engineer should be consulted to assess the impact on design recommendations.

Soil moisture content should be maintained within 2 percent of the optimum moisture content. We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. Moisture control may be difficult during rainy weather.

Filling operations should be observed by a NOVA soils technician, who can confirm suitability of material used and uniformity and appropriateness of compaction efforts. The technician can also document compliance with the specifications by performing field density tests using thin-walled tube, nuclear, or sand cone testing methods (ASTM D-2937, D-6938, or D-1556, respectively). One test per 2,500 square feet of building footprint should be performed at the stripped grade elevation and in each lift of fill, with test locations well distributed throughout the fill mass. One test at conventional spread foundations, one test at each planned column footing area, and one test per 100 linear feet at continuous strip foundations are also recommended.

### 6.3 GROUNDWATER CONTROL

Groundwater was encountered in the test borings at depths varying between about 3 feet to 4½ feet BEG at the time of our subsurface exploration, which occurred during a period of relatively normal seasonal rainfall.

Depending on the time of construction, groundwater could potentially impact the planned near surface construction, most probably (depending on fill heights) during shallow foundation and subsurface utility installations. Contractors should be prepared to utilize a dewatering system during construction to maintain separation between the groundwater levels and the desired working platforms for below-grade work.

### 6.4 FOUNDATION RECOMMENDATIONS

#### 6.4.1 General

NOVA understands the project will include the construction of a new substance abuse facility building with a planned footprint of approximately 12,000 square feet. We anticipate that the structure will be of concrete masonry unit (CMU) construction supported by a conventional shallow foundation system. Structural loadings were not available from the design team at the time of the issuance of this report. We have therefore assumed that isolated interior column and continuous load bearing wall loads will not exceed 50 kips per column and 4 kips per linear foot, respectively. Fill heights required to achieve the desired finished floor elevation (FFE) for the proposed structure have been assumed to be limited to 1 foot relative to current site grades.

#### 6.4.2 Shallow Foundation System

**Design:** After the recommended site and subgrade preparation and fill placement, we recommend that a conventional shallow foundation system be used to support the proposed structure. The foundation, bearing on densified existing soils and/or compacted structural fill as recommended in this report, may be designed employing a maximum allowable soil bearing pressure of **2,500 pounds per square foot (psf)**.

We recommend minimum footing widths of 24 inches for ease of construction and to reduce the possibility of localized shear failures. Exterior and interior footing bottoms should be established at least 20 inches below finished surrounding exterior grades.

**Settlement:** Settlements for spread foundations bearing on compacted native or approved fill materials were assessed using SPT values to estimate elastic modulus, based on published correlations and previous NOVA experience. We

note that the settlements presented are based on the results of the SPT borings. Conditions may be better or worse in other areas, however, we believe the estimated settlements are reasonably conservative.

Based on the soil bearing capacity provided above, and the presumed foundation elevations as discussed above, we expect primary total settlement beneath individual foundations to be on the order of 1 inch or less. The amount of differential settlement is difficult to predict because the subsurface and foundation loading conditions can vary considerably across the site. However, we anticipate differential settlement between adjacent foundations will be on the order of ½ inch or less. The final deflected shape of the structure will be dependent on actual foundation locations and loading.

**Should actual fill heights or assumed loadings exceed the values stated above, NOVA should be notified to determine if the zone of influence from the increased loading might encroach into this soft clay zone, thereby driving settlements above tolerable limits.**

Foundation support conditions are highly erratic and may vary dramatically in short horizontal distances. It is anticipated that the geotechnical engineer may recommend a different bearing capacity upon examination of the actual foundation subgrade at numerous locations.

To reduce the differential settlement if lower consistency materials are encountered, a lower bearing capacity should be used, or the foundations should be extended to more competent materials. We anticipate that timely communication between the geotechnical engineer and the structural engineer, as well as other design and construction team members, will be required.

**Construction:** Foundation excavations should be evaluated by the NOVA geotechnical engineer prior to reinforcing steel placement to observe foundation subgrade preparation and confirm bearing pressure capacity. Foundation excavations should be level and free of debris, ponded water, mud, and loose, frozen, or water-softened soils. Concrete should be placed as soon as is practical after the foundation is excavated, and the subgrade evaluated. Foundation concrete should not be placed on frozen or saturated soil.

If a foundation excavation remains open overnight, or if rain or snow is imminent, a 3 to 4-inch thick "mud mat" of lean concrete should be placed in the bottom of the excavation to protect the bearing soils until reinforcing steel and concrete can be placed.

## 6.5 SLAB-ON-GRADE

The conditions exposed at subgrade levels will vary across the site and may include structural fill or densified in-situ soils. The slab-on-grade may be adequately supported on these subgrade conditions subject to the recommendations in this report. The slab-on-grade should be jointed around columns and along walls to reduce cracking due to differential movement. We note that sufficient fill should be added, or an underdrain system will be necessary beneath the impacted slab, to provide a minimum separation of at least 2 feet between the bottom-of-slab elevation and the post development seasonal high groundwater level. An impermeable vapor barrier is recommended beneath finished spaces to reduce dampness.

Once grading is completed, the subgrade can be exposed to adverse construction activities and weather conditions during the period of sub-slab utility installation. The subgrade should be well drained to prevent the accumulation of water. If the exposed subgrade becomes unstable, excessively wet or exhibits excessive rutting or pumping, the geotechnical engineer should be consulted.

## 7.0 CONSTRUCTION OBSERVATIONS

### 7.1 SHALLOW FOUNDATIONS

Foundation excavations should be level and free of debris, ponded water, mud, and loose, frozen, or water-softened soils. All foundation excavations should be evaluated by a NOVA geotechnical engineer prior to reinforcing steel placement to observe foundation subgrade preparation and assess bearing pressure capacity. Due to variable site subsurface and construction conditions, some adjustments in isolated foundation bearing pressures, depth of foundations or undercutting and replacement with controlled structural fill may be necessary.

### 7.2 SUBGRADE

Once site grading is completed, the subgrade may be exposed to adverse construction activities and weather conditions. The subgrade should be well-drained to prevent the accumulation of water. If the exposed subgrade becomes saturated or frozen, the NOVA geotechnical engineer should be consulted.



# APPENDIX A

## Figures and Maps



Base map provided by *Google Earth*

**Scale:** Not To Scale

**Date Drawn:** May 2, 2023

**Drawn By:** N. Gonzalez

**Checked By:** W. Lawrence



17612 Ashley Drive  
Panama City Beach, Florida 32413  
850.249.6682 ♦ 850.249.6683

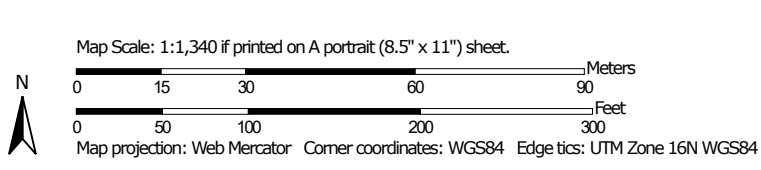
**PROJECT LOCATION MAP**

**Bay County Jail Substance Abuse Facility**  
Panama City, Bay County, Florida  
NOVA Project Number 10111-2023053

Soil Map—Bay County, Florida  
(Bay County Jail Substance Abuse Facility)



Soil Map may not be valid at this scale.






## MAP LEGEND




















### Area of Interest (AOI)







Area of Interest (AOI)

### Soils


-  Soil Map Unit Polygons
-  Soil Map Unit Lines
-  Soil Map Unit Points

### Special Point Features






-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features


### Water Features

-  Streams and Canals

### Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

### Background

-  Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

**Warning:** Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL:  
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bay County, Florida  
Survey Area Data: Version 22, Sep 1, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 2, 2020—Dec 8, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

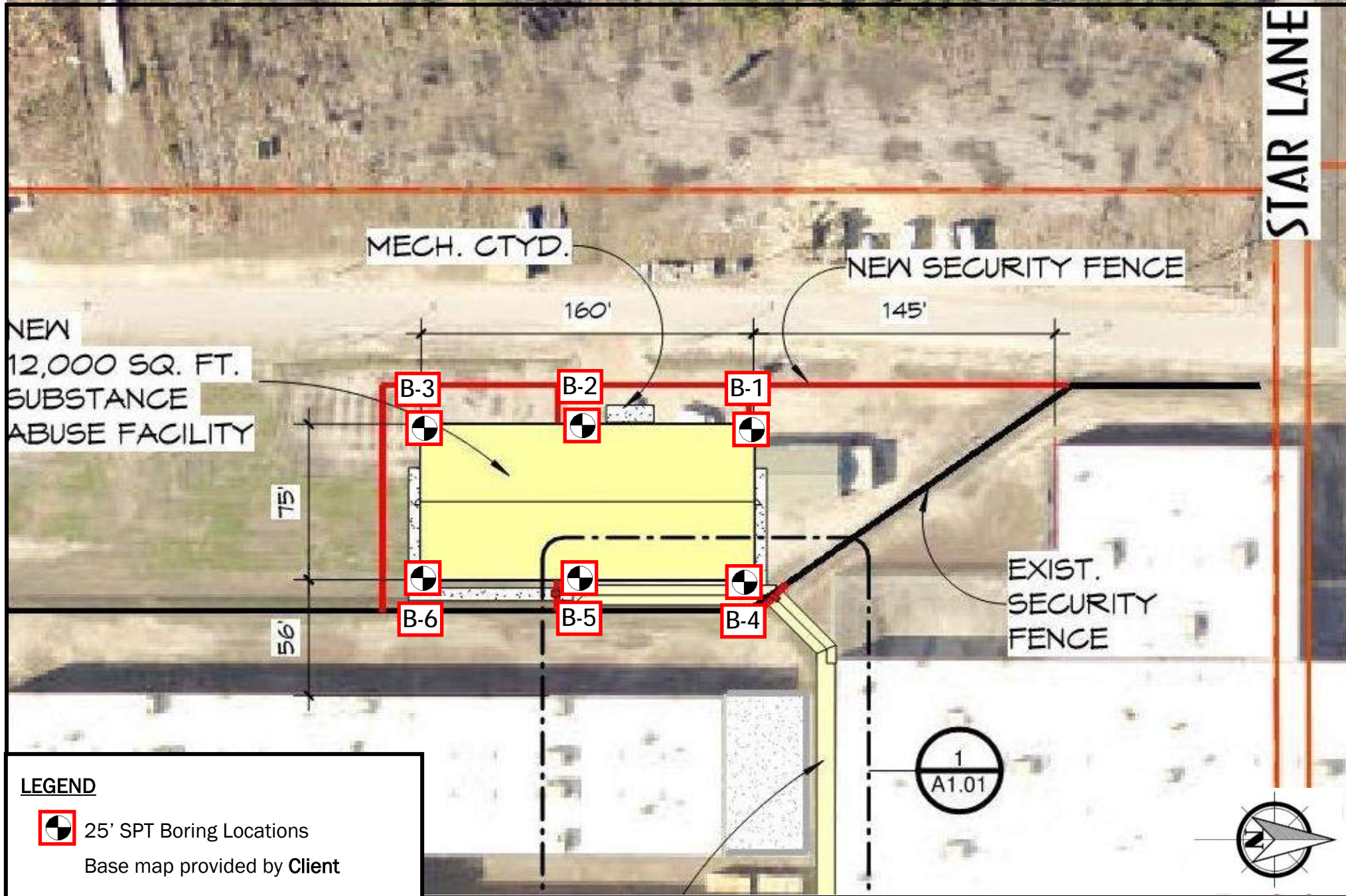
## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
12	Leefield sand, 0 to 2 percent slopes	6.2	100.0%
<b>Totals for Area of Interest</b>		<b>6.2</b>	<b>100.0%</b>


# **APPENDIX B**

## **Subsurface Data**

STAR LANE



**LEGEND**

 25' SPT Boring Locations  
 Base map provided by Client






Scale: Not To Scale  
 Date Drawn: May 2, 2023  
 Drawn By: N. Gonzalez  
 Checked By: W. Lawrence



17612 Ashley Drive  
 Panama City Beach, Florida 32413  
 850.249.NOVA(6682) ♦ 850.249.6683

**BORING LOCATION PLAN**  
 Bay County Jail Substance Abuse Facility  
 Panama City, Bay County, Florida  
 NOVA Project Number 10111-2023053

## SYMBOLS AND ABBREVIATIONS

<u>SYMBOL</u>	<u>DESCRIPTION</u>
N-Value	No. of Blows of a 140-lb. Weight Falling 30 Inches Required to Drive a Standard Spoon 1 Foot
WOR	Weight of Drill Rods
WOH	Weight of Drill Rods and Hammer
	Sample from Auger Cuttings
	Standard Penetration Test Sample
	Thin-wall Shelby Tube Sample (Undisturbed Sampler Used)
% REC	Percent Core Recovery from Rock Core Drilling
RQD	Rock Quality Designation
	Stabilized Groundwater Level
	Seasonal High Groundwater Level (also referred to as the W.S.W.T.)
NE	Not Encountered
GNE	Groundwater Not Encountered
BT	Boring Terminated
-200 (%)	Fines Content or % Passing No. 200 Sieve
MC (%)	Moisture Content
LL	Liquid Limit (Atterberg Limits Test)
PI	Plasticity Index (Atterberg Limits Test)
K	Coefficient of Permeability
Org. Cont.	Organic Content
G.S. Elevation	Ground Surface Elevation

## UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS More than 50% retained on the No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW Well-graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GP Poorly graded gravels and gravel-sand mixtures, little or no fines
			GM Silty gravels and gravel-sand-silt mixtures
		SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS 5% or less passing No. 200 sieve
	SANDS with 12% or more passing No. 200 sieve		SW** Well-graded sands and gravelly sands, little or no fines
		SP** Poorly graded sands and gravelly sands, little or no fines	
FINE-GRAINED SOILS 50% or more passes the No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less	SM** Silty sands, sand-silt mixtures	
		SC** Clayey sands, sand-clay mixtures	
		ML Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	
	SILTS AND CLAYS Liquid limit greater than 50%	CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays	
		OL Organic silts and organic silty clays of low plasticity	
		MH Inorganic silts, micaceous or diamicaceous fine sands or silts, elastic silts	
		CH Inorganic clays or clays of high plasticity, fat clays	
		OH Organic clays of medium to high plasticity	
		PT Peat, muck and other highly organic soils	

\*Based on the material passing the 3-inch (75 mm) sieve

\*\* Use dual symbol (such as SP-SM and SP-SC) for soils with more than 5% but less than 12% passing the No. 200 sieve

### RELATIVE DENSITY

(Sands and Gravels)

Very loose – Less than 4 Blow/Foot  
 Loose – 4 to 10 Blows/Foot  
 Medium Dense – 11 to 30 Blows/Foot  
 Dense – 31 to 50 Blows/Foot  
 Very Dense – More than 50 Blows/Foot

### CONSISTENCY

(Silts and Clays)

Very Soft – Less than 2 Blows/Foot  
 Soft – 2 to 4 Blows/Foot  
 Medium Stiff – 5 to 8 Blows/Foot  
 Stiff – 9 to 15 Blows/Foot  
 Very Stiff – 16 to 30 Blows/Foot  
 Hard – More than 30 Blows/Foot

### RELATIVE HARDNESS

(Limestone)

Soft – 100 Blows for more than 2 Inches  
 Hard – 100 Blows for less than 2 Inches

### MODIFIERS

**These modifiers Provide Our Estimate of the Amount of Minor Constituents (Silt or Clay Size Particles) in the Soil Sample**

Trace – 5% or less  
 With Silt or With Clay – 6% to 11%  
 Silty or Clayey – 12% to 30%  
 Very Silty or Very Clayey – 31% to 50%

**These Modifiers Provide Our Estimate of the Amount of Organic Components in the Soil Sample**

Trace – Less than 3%  
 Few – 3% to 4%  
 Some – 5% to 8%  
 Many – Greater than 8%

**These Modifiers Provide Our Estimate of the Amount of Other Components (Shell, Gravel, Etc.) in the Soil Sample**

Trace – 5% or less  
 Few – 6% to 12%  
 Some – 13% to 30%  
 Many – 31% to 50%

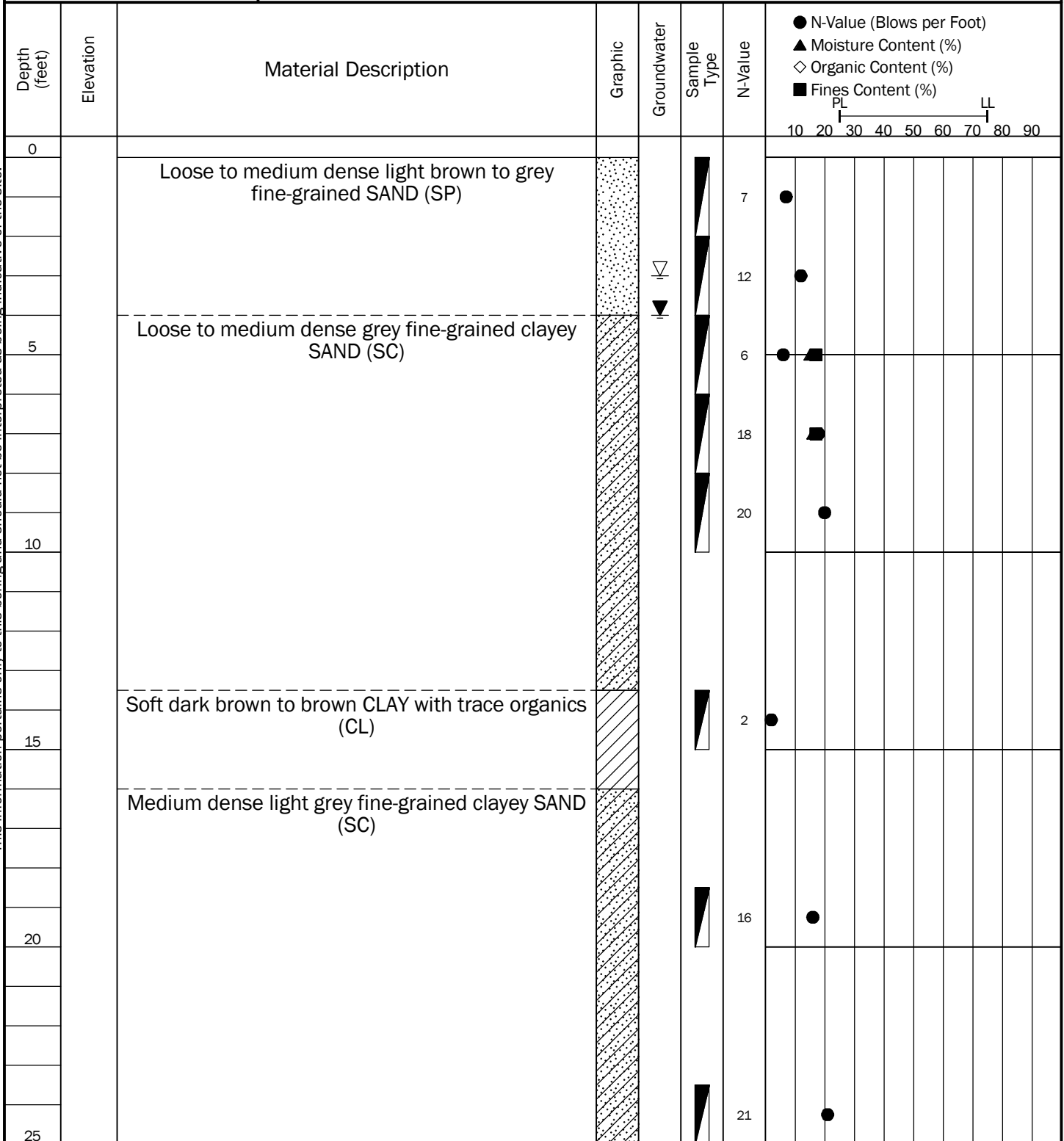




# TEST BORING RECORD B-1

PROJECT NAME: Bay County Jail Substance Abuse Facility      DATE: 3/30/2023  
 PROJECT NO.: 2023053      CLIENT: Bay County Public Works Division  
 PROJECT LOCATION: Panama City, Bay County, Florida  
 LOCATION: See Boring Location Plan      ELEVATION: Existing Grade  
 DRILLED BY: L. Griffin      LOGGED BY: N. Gonzalez  
 DRILLING METHOD: Mud Rotary      HAMMER: Manual  
 INITIAL GW DEPTH: 4 feet      EST. SHGW DEPTH: 3 feet

This information pertains only to this boring and should not be interpreted as being indicative of the site.



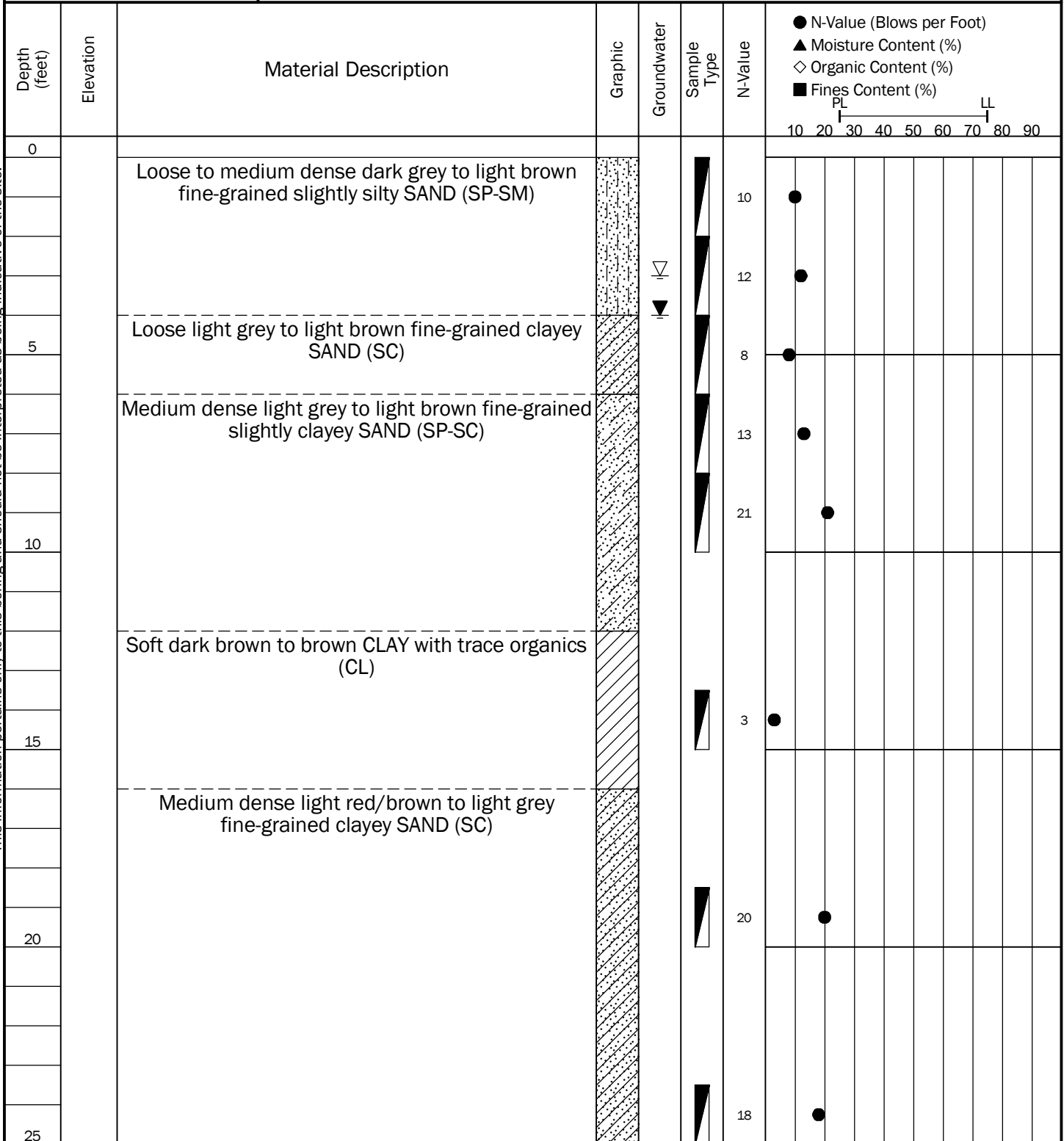
Note: Boring Terminated at 25 feet



# TEST BORING RECORD B-2

**PROJECT NAME:** Bay County Jail Substance Abuse Facility    **DATE:** 3/30/2023  
**PROJECT NO.:** 2023053    **CLIENT:** Bay County Public Works Division  
**PROJECT LOCATION:** Panama City, Bay County, Florida  
**LOCATION:** See Boring Location Plan    **ELEVATION:** Existing Grade  
**DRILLED BY:** L. Griffin    **LOGGED BY:** N. Gonzalez  
**DRILLING METHOD:** Mud Rotary    **HAMMER:** Manual  
**INITIAL GW DEPTH:** ▼ 4 feet    **EST. SHGW DEPTH:** ▽ 3 feet

This information pertains only to this boring and should not be interpreted as being indicative of the site.



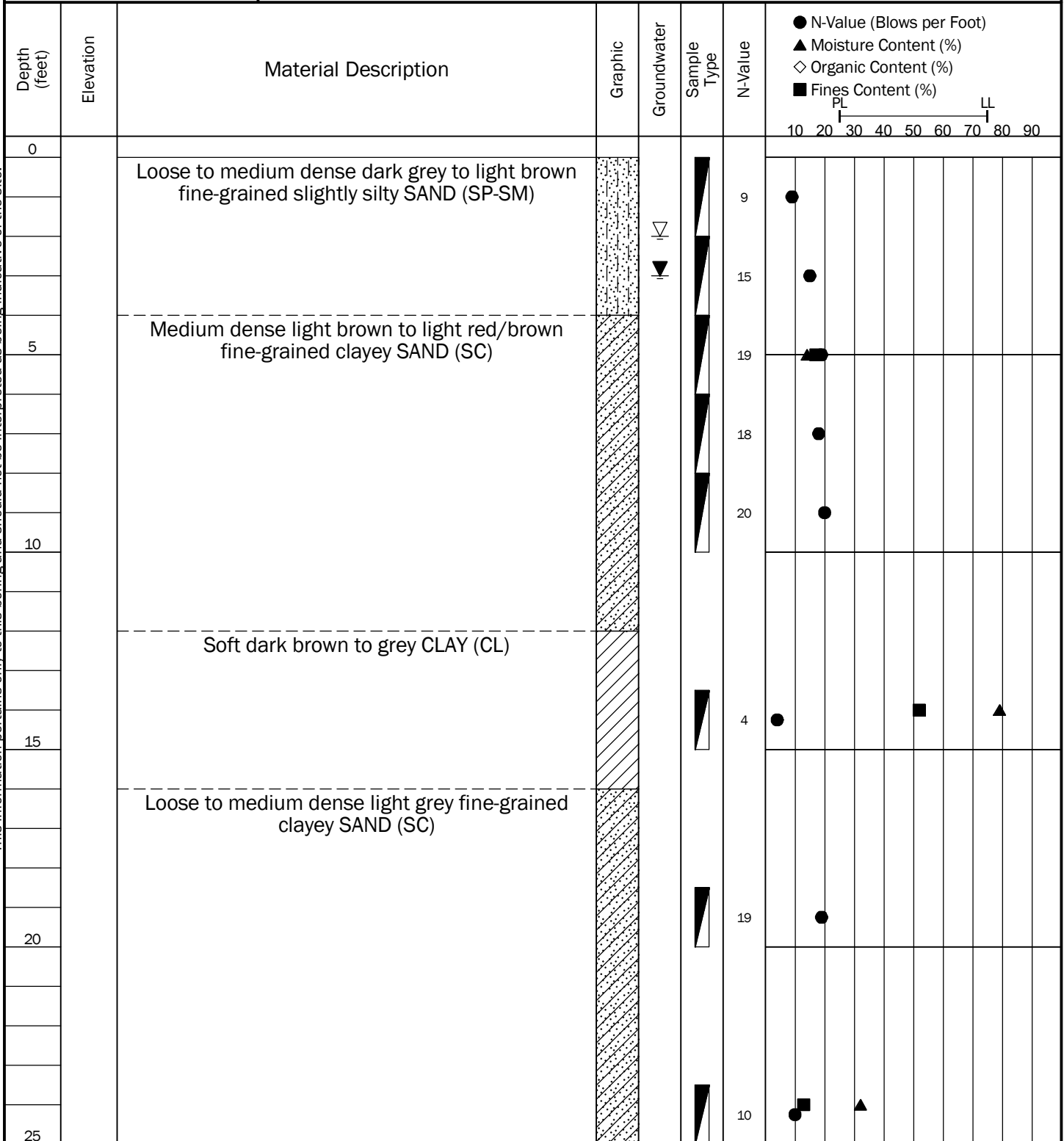
Note: Boring Terminated at 25 feet



# TEST BORING RECORD B-3

**PROJECT NAME:** Bay County Jail Substance Abuse Facility    **DATE:** 3/30/2023  
**PROJECT NO.:** 2023053    **CLIENT:** Bay County Public Works Division  
**PROJECT LOCATION:** Panama City, Bay County, Florida  
**LOCATION:** See Boring Location Plan    **ELEVATION:** Existing Grade  
**DRILLED BY:** L. Griffin    **LOGGED BY:** N. Gonzalez  
**DRILLING METHOD:** Mud Rotary    **HAMMER:** Manual  
**INITIAL GW DEPTH:** 3 feet    **EST. SHGW DEPTH:** 2 feet

This information pertains only to this boring and should not be interpreted as being indicative of the site.



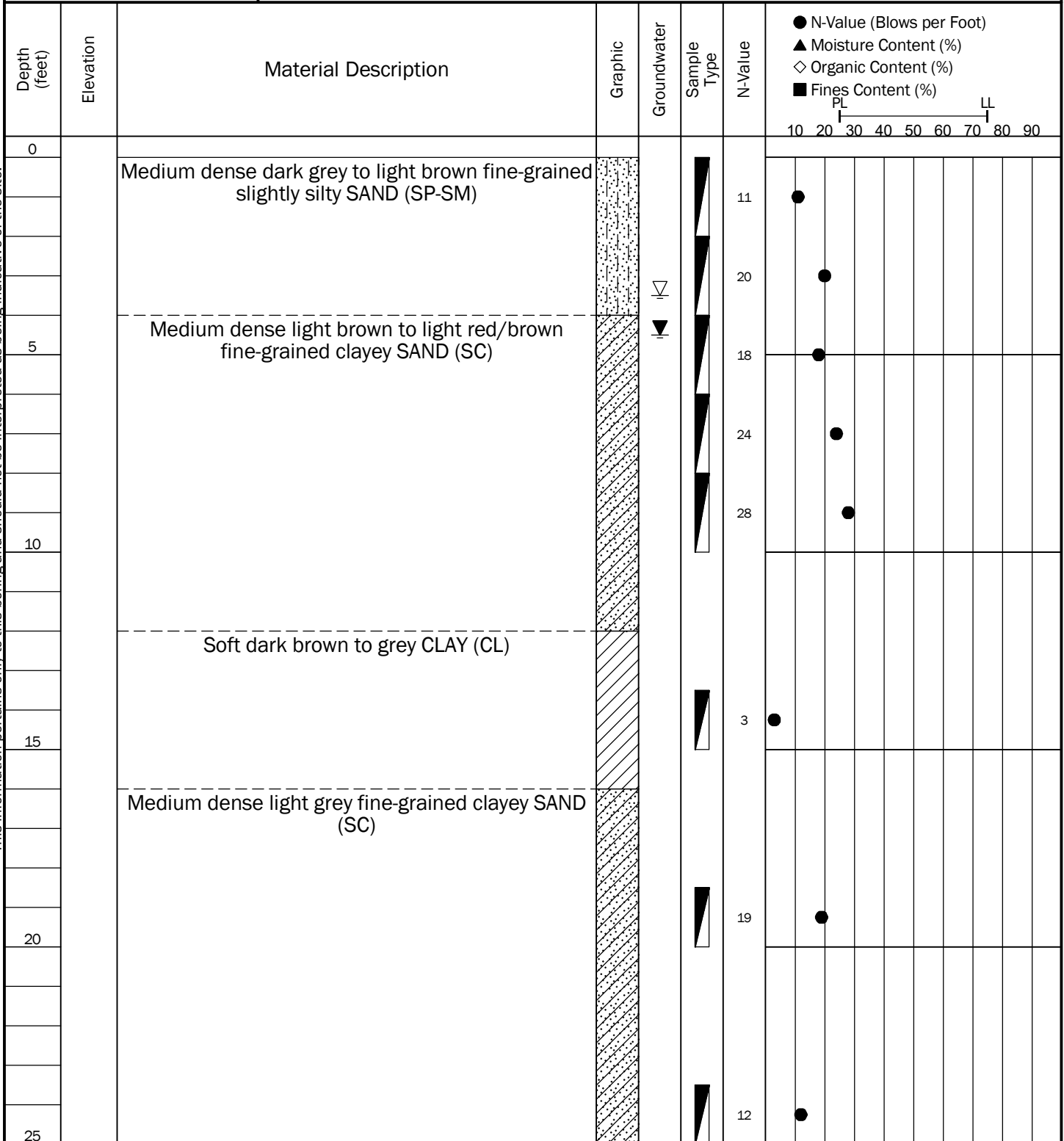
Note: Boring Terminated at 25 feet



# TEST BORING RECORD B-4

PROJECT NAME: Bay County Jail Substance Abuse Facility      DATE: 3/30/2023  
 PROJECT NO.: 2023053      CLIENT: Bay County Public Works Division  
 PROJECT LOCATION: Panama City, Bay County, Florida  
 LOCATION: See Boring Location Plan      ELEVATION: Existing Grade  
 DRILLED BY: L. Griffin      LOGGED BY: N. Gonzalez  
 DRILLING METHOD: Mud Rotary      HAMMER: Manual  
 INITIAL GW DEPTH: 4.5 feet      EST. SHGW DEPTH: 3.5 feet

This information pertains only to this boring and should not be interpreted as being indicative of the site.



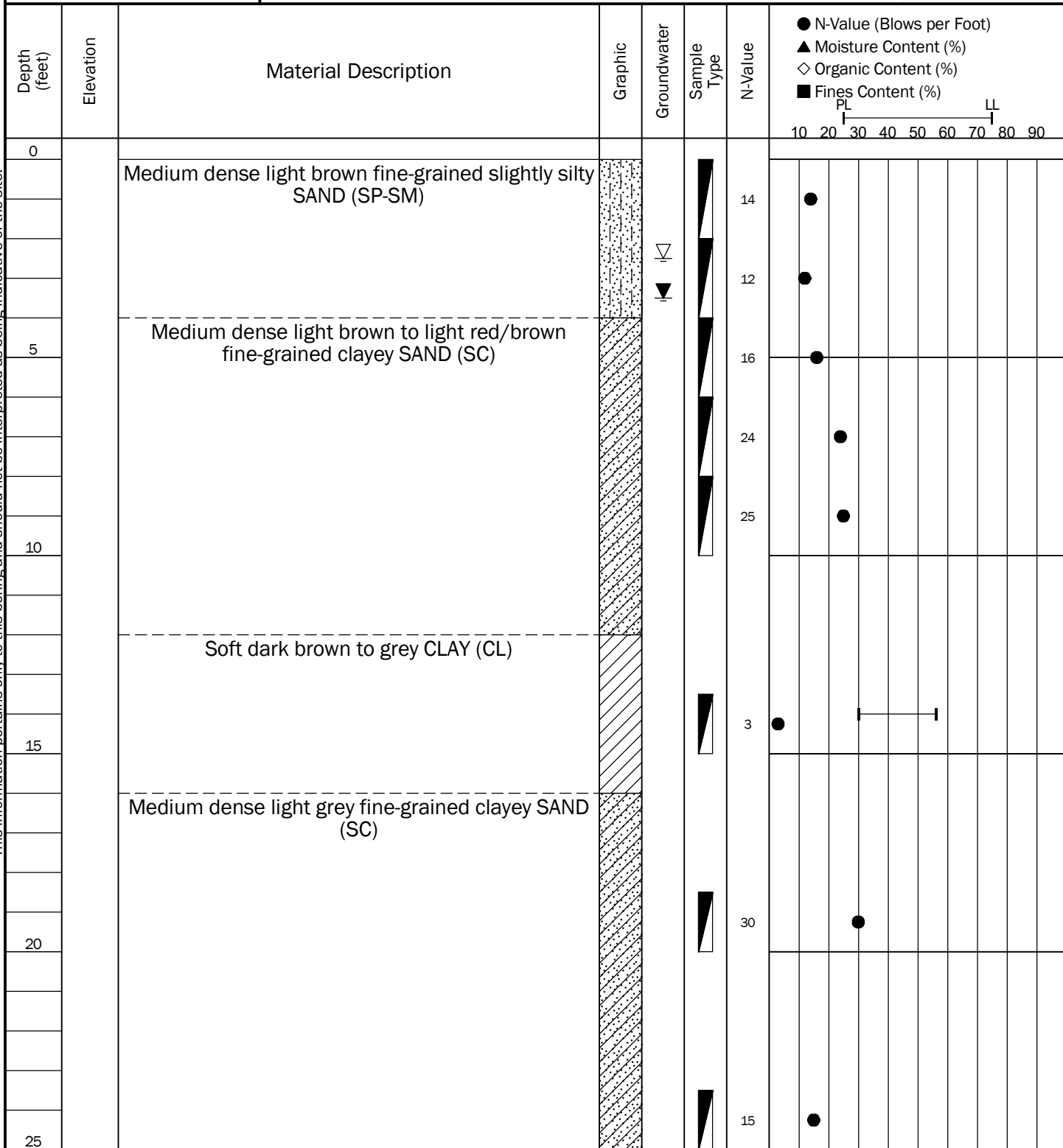
Note: Boring Terminated at 25 feet



# TEST BORING RECORD B-5

PROJECT NAME: Bay County Jail Substance Abuse Facility DATE: 3/30/2023  
 PROJECT NO.: 2023053 CLIENT: Bay County Public Works Division  
 PROJECT LOCATION: Panama City, Bay County, Florida  
 LOCATION: See Boring Location Plan ELEVATION: Existing Grade  
 DRILLED BY: L. Griffin LOGGED BY: N. Gonzalez  
 DRILLING METHOD: Mud Rotary HAMMER: Manual  
 INITIAL GW DEPTH: 3.5 feet EST. SHGW DEPTH: 2.5 feet

This information pertains only to this boring and should not be interpreted as being indicative of the site.



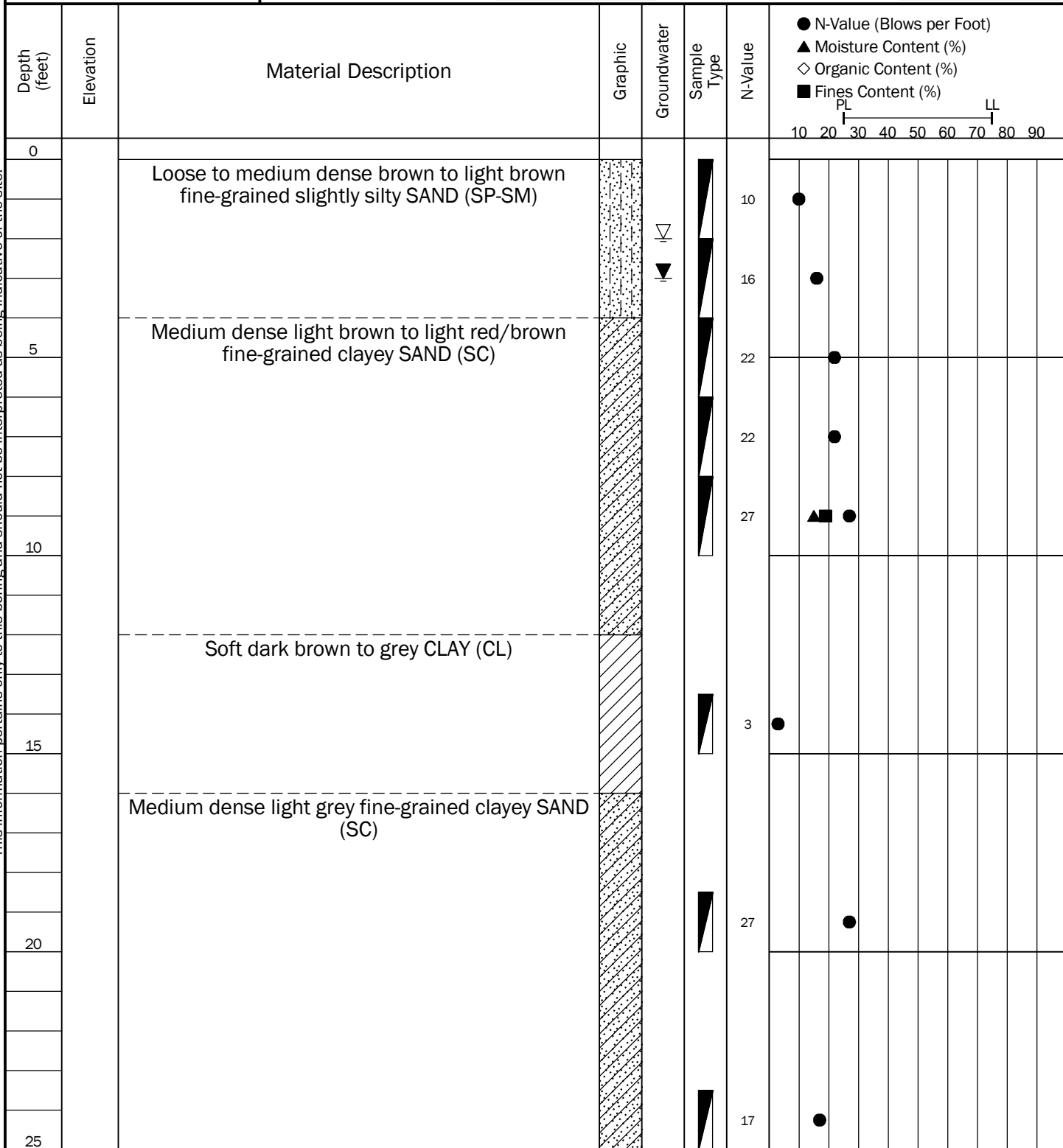
Note: Boring Terminated at 25 feet



# TEST BORING RECORD B-6

PROJECT NAME: Bay County Jail Substance Abuse Facility      DATE: 3/30/2023  
 PROJECT NO.: 2023053      CLIENT: Bay County Public Works Division  
 PROJECT LOCATION: Panama City, Bay County, Florida  
 LOCATION: See Boring Location Plan      ELEVATION: Existing Grade  
 DRILLED BY: L. Griffin      LOGGED BY: N. Gonzalez  
 DRILLING METHOD: Mud Rotary      HAMMER: Manual  
 INITIAL GW DEPTH: 3 feet      EST. SHGW DEPTH: 2 feet

This information pertains only to this boring and should not be interpreted as being indicative of the site.



Note: Boring Terminated at 25 feet

# APPENDIX C

## Laboratory Data

## SUMMARY OF CLASSIFICATION & INDEX TESTING

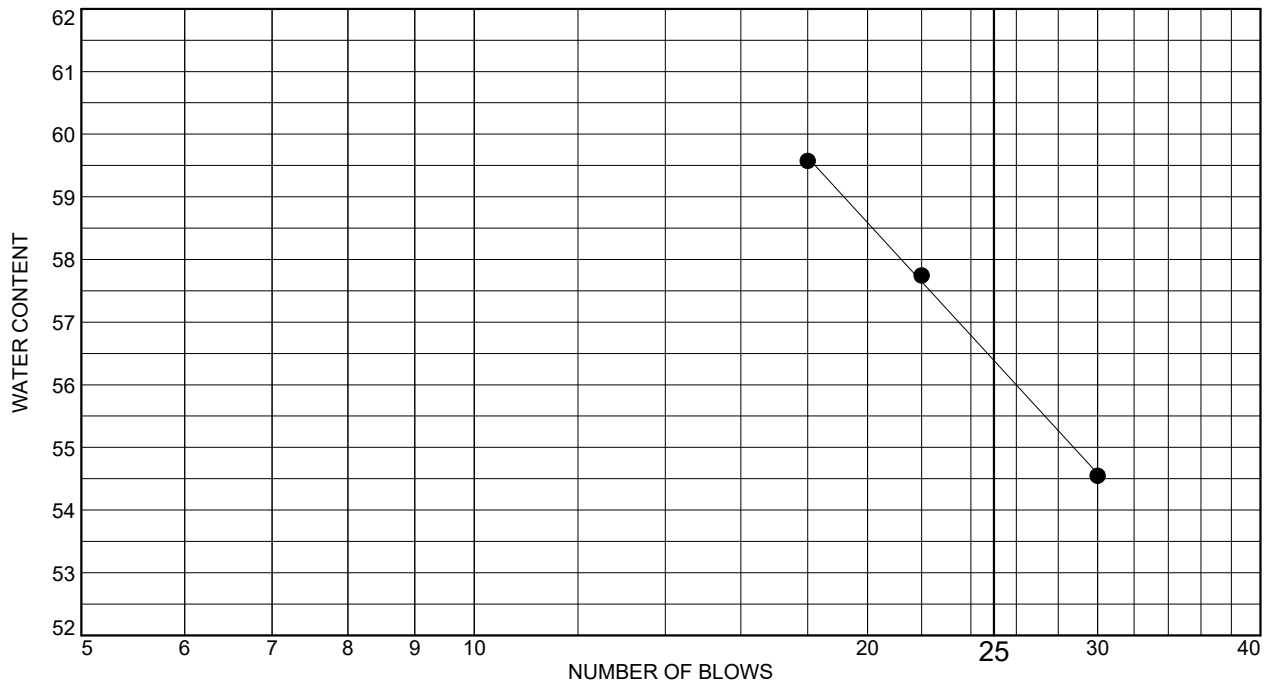
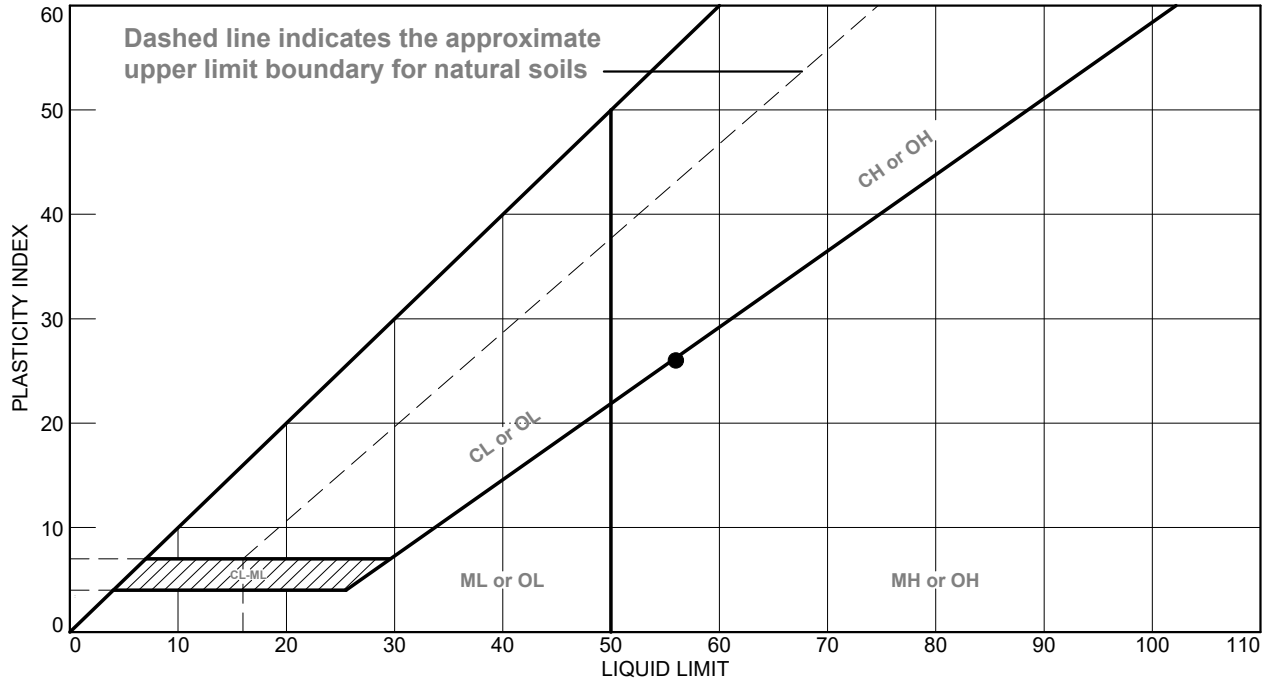
Bay County Jail Substance Abuse Facility  
Panama City, Bay County, Florida  
NOVA Project Number 10111-2023053

Boring Number	Sample Depth (ft)	Natural Moisture (%)	Percent (%) Passing Sieve #200	USCS Soil Classification
B-1	4 - 6	15	17	SC
B-1	6 - 8	16	17	SC
B-3	4 - 6	14	17	SC
B-3	13 ½ - 15	79	52	CL
B-3	23 ½ - 25	32	13	SC
B-6	8 - 10	15	19	SC





# LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Brown and Gray Clay	56	30	26			

**Project No.** 2023053      **Client:** Bay County Public Works Department - Capital  
**Project:** Bay County Jail Substance Abuse Facility  
**Sample Number:** B-5      **Depth:** 13.5'  
**Nova Engineering & Environmental**  
**Panama City, FL**

**Remarks:**  
● Natural Moisture: 56.8%

**Figure**

# APPENDIX D

## Support Documents

## QUALIFICATIONS OF RECOMMENDATIONS

The findings, conclusions and recommendations presented in this report represent our professional opinions concerning subsurface conditions at the site. The opinions presented are relative to the dates of our site work and should not be relied on to represent conditions at later dates or at locations not explored. The opinions included herein are based on information provided to us, the data obtained at specific locations during the study, and our previous experience. If additional information becomes available which might impact our geotechnical opinions, it will be necessary for NOVA to review the information, re-assess the potential concerns, and re-evaluate our conclusions and recommendations.

Regardless of the thoroughness of a geotechnical exploration, there is the possibility that conditions between borings may differ from those encountered at specific boring locations, that conditions are not as anticipated by the designers and/or the contractors, or that either natural events or the construction process has altered the subsurface conditions. These variations are an inherent risk associated with subsurface conditions in this region and the approximate methods used to obtain the data. These variations may not be apparent until construction.

The professional opinions presented in this report are not final. Field observations and foundation installation monitoring by the geotechnical engineer, as well as soil density testing and other quality assurance functions associated with site earthwork and foundation construction, are an extension of this report. Therefore, NOVA should be retained by the owner to observe all earthwork and foundation construction to confirm that the conditions anticipated in this study actually exist, and to finalize or amend our conclusions and recommendations. NOVA is not responsible or liable for the conclusions and recommendations presented in this report if NOVA does not perform these observation and testing services.

This report is intended for the sole use of **Bay County - Public Works Division**, only. The scope of work performed during this study was developed for purposes specifically intended by **Bay County - Public Works Division**, only, and may not satisfy other users' requirements. Use of this report or the findings, conclusions or recommendations by others will be at the sole risk of the user. NOVA is not responsible or liable for the interpretation by others of the data in this report, nor their conclusions, recommendations, or opinions.

Our professional services have been performed, our findings obtained, our conclusions derived, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices in the State of Florida. This warranty is in lieu of all other statements or warranties, either expressed or implied.

# Important Information about This

# Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

## Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply this report for any purpose or project except the one originally contemplated.*

## Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an

assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by:* the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

## Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

## A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

### **Do Not Redraw the Engineer's Logs**

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

### **Give Constructors a Complete Report and Guidance**

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

### **Read Responsibility Provisions Closely**

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help

others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### **Environmental Concerns Are Not Covered**

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

### **Obtain Professional Assistance To Deal with Mold**

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold-prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical-engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

### **Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance**

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your GBC-Member geotechnical engineer for more information.



8811 Colesville Road/Suite G106, Silver Spring, MD 20910  
Telephone: 301/565-2733 Facsimile: 301/589-2017  
e-mail: [info@geoprofessional.org](mailto:info@geoprofessional.org) [www.geoprofessional.org](http://www.geoprofessional.org)

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## SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete and anchorage.
2. Formwork accessories.
3. Form stripping.
4. Reinforcing steel for cast-in-place concrete.
5. Cast-in-place concrete, including concrete for the following:
  - a. Foundations, footings.
  - b. Slabs on grade.
  - c. Equipment pads and bases.
  - d. Concrete beam(s).
6. Concrete curing.

B. Related Sections:

1. Precast, Pre-stressed Hollowcore Plank: Division 3

#### 1.02 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and technical specification sections, apply to work of this section.

#### 1.02 DEFINITIONS

- A. Unexposed Finish: A general-use finish, with no appearance criteria, applicable to all formed concrete concealed from view after completion of construction.
- B. Exposed Finish: A general-use finish applicable to all formed concrete exposed to view and including surfaces which may receive a paint coating (if any).

#### 1.03 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for fabrication and placement of the following:
1. Reinforcement: Comply with ACI SP-66. Include bar schedules, diagrams of bent bars, arrangement of concrete reinforcement, and splices. Show construction joints.
- B. Quality Control Submittals: Submit the following information related to quality assurance requirements specified: Design data: Submit proposed mix designs and test data before concrete operations begin. Identify for each mix submitted the method by which proportions have been selected.
1. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength (f'c) calculations.
  2. For mix designs based on trial mixtures, include trial mix proportions, test results, and graphical analysis and show required average compressive strength (f'c).
  3. Indicate quantity of each ingredient per cubic yard of concrete.
  4. Indicate type and quantity of admixtures proposed or required.
  5. Test reports: Submit laboratory test reports for all testing specified.
  6. Certifications: Submit affidavits from an independent testing agency certifying that all materials

furnished under this section conform to specifications.

7. Certifications: Provide certification from manufacturers of concrete admixtures that chloride content complies with specified requirements.
8. Submit batch tickets complying with ASTM C 685 or delivery tickets complying with ASTM C 94, as applicable, for each load of concrete used in the work.

#### 1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the following documents, except where requirements of the contract documents or of governing authorities are more stringent:
  1. ACI 301.
  2. ACI 318.
  3. CRSI Manual of Standard Practice.
- B. Testing Agency Services:
  1. Employ, at contractor's expense, an independent testing agency by the Owner "Bay County" to perform specified tests and other services required for quality assurance.
    - a. Testing agency shall meet ASTM E 329 requirements.
- C. Source of Materials: Obtain materials of each type from same source for the entire project.

#### 1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.
  1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete Subcontractor.
    - e. Special concrete finish Subcontractor.
  2. Review the following:
    - a. Special inspection (if required, see drawings) and testing and inspecting agency procedures for field quality control.
    - b. Construction joints, control joints, isolation joints, and joint-filler strips.
    - c. Semirigid joint fillers.
    - d. Vapor-retarder installation.
    - e. Anchor rod and anchorage device installation tolerances.
    - f. Cold and hot weather concreting procedures and ACI Standards.
    - g. Concrete finishes and finishing.
    - h. Curing procedures.
    - i. Forms and form-removal limitations.
    - j. Methods for achieving specified floor and slab flatness and levelness.
    - k. Floor and slab flatness and levelness measurements.
    - l. Concrete repair procedures.
    - m. Concrete protection.
    - m. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
    - o. Protection of field cured field test cylinders.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver reinforcement to project site bundled and tagged with metal tags indicating bar size, lengths and other data corresponding to information shown on placement drawings.
  - 1. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or rust.
  - 2. Store cementitious materials in a dry, weather tight location. Maintain accurate records of shipment and use.
- B. Store aggregates to permit free drainage and to avoid contamination with deleterious matter or other aggregates. When stockpiled on ground, discard bottom 6 inches of pile.
- C. Handle aggregates to avoid segregation.

## PART 2 - PRODUCTS

### 2.01 FORM WORK

- A. Facing Materials:
  - 1. Unexposed finish concrete: Any standard form materials that produce structurally sound concrete. Exposed finish concrete: Materials selected to offer optimum smooth, stain-free final appearance and minimum number of joints. Provide materials with sufficient strength to resist hydrostatic head without bow or deflection in excess of allowable tolerances, and as follows:
    - a. Plywood: PS-I "B-B (Concrete Form) Plywood", Class I, Exterior Grade, mill-oiled and edge sealed.
- B. Form Work Accessories:
  - 1. Form coating: Form release agent that will not adversely affect concrete surfaces or prevent subsequent application of concrete coatings.
  - 2. Metal ties: Commercially manufactured types; cone snap ties, taper removable bolt, or other type which will leave no metal closer than 1-1/2 inches from surface of concrete when forms are removed, leaving not more than a 1-inch diameter hole in concrete surface.
  - 3. Fillets: Wood or plastic fillets for chamfered corners, in maximum lengths possible.

### 2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: Provide deformed bars complying with the following, except where otherwise indicated: ASTM A 615, Grade 60.
- B. Welded Wire Fabric: ASTM A1064, cold-drawn steel, plain.
- C. Reinforcing Accessories:
  - 1. Tie wire: Black annealed type, 16-1/2 gage or heavier.
  - 2. Supports: Bar supports conforming to specifications of CRSI "Manual of Standard Practice". Class I (plastic protected) at all formed surfaces which will be exposed to weather. Class 1 (plastic protected) or Class 2 (stainless steel protected) at all formed surfaces which will be exposed to view but not to weather. Precast concrete blocks of strength equal to or greater than specified strength of concrete or Class 3 supports equipped with sand plates, where concrete will be cast against earth. Concrete masonry units will not be accepted.

### 2.03 CONCRETE MATERIALS

- A. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.
- B. Portland Cement: ASTM C 150, and as follows: Type I, II, I/II, III (if high early strength is required).
  - 2. Fly Ash: ASTM C618, Class F, except that the maximum allowable loss on ignition must not exceed 3 percent. Fly ash content must be a minimum of 15 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level,



provide the maximum amount of fly ash permissible that meets the code requirements for cement content. Report the chemical analysis of the fly ash in accordance with ASTM C311/C311M. Evaluate and classify fly ash in accordance with ASTM D5759.

3. Water: Potable
  4. Cementitious materials must be stored and kept dry and free from contaminants.
- B. Aggregates:
1. Normal weight concrete: ASTM C 33.
    - a. Class IN. Provide sand that is at least 50 percent acid insoluble based on ASTM D3042.
    - b. Gradation as specified below under mix design.
    - c. Aggregates used in concrete must be obtained from the same sources and have the same size range as aggregates used in concrete represented by submitted field test records or used in trial mixtures.
    - d. Store and handle aggregate in a manner that will avoid segregation and prevents contamination by other materials or other sizes of aggregates. Store aggregates in locations that will permit them to drain freely. Do not use aggregates that contain frozen lumps.
- C. Admixtures - General: Admixtures which result in more than 0.1 percent of soluble chloride ions by weight of cement are prohibited.
1. Chemical admixtures must conform to ASTM C494/C494M.
  2. Chemical admixtures for use in producing flowing concrete must conform to ASTM C1017/C1017M.
  3. Do not use calcium chloride admixtures.
  4. Submit types, brand names, producers' names, manufacturer's technical data sheets, and certificates showing compliance with standards required herein.
- D. Air-Entraining Admixture: ASTM C 260 and certified by manufacturer for compatibility with other mix components.
- E. Water-Reducing Admixture: ASTM C 494, Type A.
- F. Concrete Curing Materials - Provide concrete curing material in accordance with ACI 301 Section 5 and ACI 308.1 Section 2. Submit product data for concrete curing compounds. Submit manufacturer's instructions for placement of curing compound.

#### 2.04 GROUT MIXES FOR UNIT MASONRY

- A. Comply with ASTM C476. Use grout of consistency that will completely fill spaces intended to receive grout. Grout shall be 3000 psi minimum and shall be capable of passing through a 1" diameter pump hose.

#### 2.05 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Vapor Retarder: Membrane for installation beneath slabs on grade, resistant to decay when tested in accordance with ASTM E 154, and as follows:
1. 15 mil polyethylene.
- B. Nonshrink Grout: ASTM C 1107.
1. Type: Provide nonmetallic type only, minimum compressive strength 5000 psi.
- C. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.
- D. Moisture-Retaining Cover: ASTM C 171, and as follows:
1. Curing paper.
  2. Polyethylene film.
  3. White burlap-polyethylene sheeting.
- F. Liquid Curing Compounds:
1. Provide concrete curing material in accordance with ACI 30 Section 5 and ACI 308.1 Section 2. Submit product data for concrete curing compounds. Submit manufacturer's instructions for

placement of curing compound.

2. Material - curing compounds: Comply with ASTM C 309, Type I.
  - a. Non-yellowing formulation where subject to ultraviolet light.
  - b. Curing and sealing compound: Where indicated, provide curing and sealing formulation with long-lasting finish that is resistant to chemicals, oil, grease, deicing salts, and abrasion.
- G. Bonding Compound: Non-redispersable acrylic bonding admixture, ASTM C 1059, Type II.
- H. Epoxy Bonding Systems: ASTM C 881; type, grade and class as required for project conditions.

## 2.06 CONCRETE MIX DESIGN

- A. Review: Do not begin concrete operations until proposed mix has been reviewed by the DBT Architect and Engineer.
- B. Proportioning of Normal Weight Concrete: Comply with recommendations of ACI 211.1.
- C. Required Average Strength: Establish the required average strength  $f_{cr}$  of the design mix on the basis of either field experience or trial mixtures as specified in ACI 301, and proportion mixes accordingly. If trial mixtures method is used, employ an independent testing agency acceptable to the Architect for preparing and reporting proposed mix design.
- D. Admixtures:
  1. Air-entraining admixture: Add at rate to achieve specified air content.
    - a. Do not use in slabs-on-grade scheduled to receive topping or troweled finish, unless manufacturer of topping recommends use over air-entrained concrete.
  2. Water-reducing admixture: Add as required for placement and workability.
  3. Do not use admixtures not specified or approved.
- E. Design mix to meet or exceed each requirement specified. Where more than one criterion is specified, the most stringent shall apply. For example, a minimum cement content or maximum water-cement ratio may be required in order to achieve the required strength.
  1. Specified compressive strength (minimum) ( $f'_{c}$ ) (ASTM C 39): 3500 psi at 28 days. Maximum water-cement ratio by weight: 0.46 maximum for air-entrained concrete. Maximum slump:  $4" \pm 1"$
  2. Maximum nominal size of coarse aggregate: As recommended in ACI 211.1.
  3. Total air content (ASTM C 173 or ASTM C 231): 3 percent.
- F. Mix adjustments: Provided that no additional expense to owner is involved, contractor may submit for Architect's approval requests for adjustment to approved concrete mixes when circumstances such as changed project conditions, weather or unfavorable test results occur. Include laboratory test data substantiating specified properties with mix adjustment requests.

## 2.07 CONTROL OF MIX IN THE FIELD

- A. Slump: A tolerance of up to 1 inch above that specified will be permitted for 1 batch in 5 consecutive batches tested. Concrete of lower slump than that specified may be used, provided proper placing and consolidation is obtained.
  1. No addition of water will be acceptable after initial batching of the concrete at the batching plant.
- B. Do not use batches that exceed tolerances.

## 2.08 CONCRETE MIXING

- A. On-Site Equipment: Mix concrete materials in appropriate drum type batch machine mixer, in compliance with ASTM C 685. Mix each batch minimum of 1-1/2 minutes and maximum of 5 minutes before discharging concrete. Clean thoroughly at end of day and before changing concrete type.
- B. Transit Mixers: Mix concrete materials in transit mixers, complying with requirements of ASTM C 94.

## PART 3 - EXECUTION

### 3.01 CONCRETE FORM PREPARATION

- A. General: Comply with requirements of ACI 301 for form work, and as herein specified. The contractor is responsible for design, engineering, and construction of form work, and for its timely removal.
- B. Earth Forms: Hand-trim bottoms and sides of earth forms to profiles indicated on the drawings. Remove loose dirt before placing concrete.
- C. Design: Design and fabricate forms for easy removal, without impact, shock, or damage to concrete surfaces or other portions of the work. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.
- D. Construction: Construct and brace form work to accurately achieve end results required by contract documents, with all elements properly located and free of distortion. Provide for necessary openings, inserts, anchorages, and other features shown or otherwise required.
  - 1. Joints: Minimize form joints and make watertight to prevent leakage of concrete.
  - 2. Align joints symmetrically at exposed conditions.
  - 3. Chamfers: Provide chamfered edges and comers at exposed locations, unless specifically indicated otherwise on the drawings.
  - 4. Permanent openings: Provide openings to accommodate work of other trades, sized and located accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in form work.
  - 5. Temporary openings: Provide temporary openings for cleaning and inspection in most inconspicuous locations at base of forms, closed with tight-fitting panels designed to minimize appearance of joints in finished concrete work.
- E. Tolerances for Formed Surfaces: Comply with minimum tolerances established in ACI 117, unless more stringent requirements are indicated on the drawings.
- F. Release Agent: Provide either form materials with factory-applied nonabsorptive liner or field-applied form coating. If field-applied coating is employed, thoroughly clean and recondition form work and reapply coating before each use. Rust on form surfaces is unacceptable.
- G. SLOPE CONCRETE SLABS TO FLOOR DRAINS AS SHOWN ON THE DRAWINGS. Slab surfaces that are not properly sloped to floor drains (at least 1/8" per foot) will be required to be removed and replaced.

### 3.02 VAPOR RETARDER INSTALLATION

- A. General: Place vapor retarder sheet over prepared base material, aligning longer dimension parallel to direction of pour and lapped 6 inches. Seal joints with appropriate tape.

### 3.03 PLACING REINFORCEMENT

- A. General: Comply with requirements of ACI 301 and as herein specified.
- B. Preparation: Clean reinforcement of loose rust and mill scale, soil, and other materials which adversely affect bond with concrete.
- C. Placement: Place reinforcement to achieve not less than minimum concrete coverages required for protection. Accurately position, support, and secure reinforcement against displacement. Provide Class C tension lap splices complying with ACI 318 unless otherwise indicated. Do not field-bend partially embedded bars unless otherwise indicated or approved.
  - 1. Use approved bar supports and tie wire, as required. Set wire ties to avoid contact with or penetration of exposed concrete surfaces. Tack welding of reinforcing is not permitted.
  - 2. Wire fabric: Install in maximum lengths possible, lapping adjoining pieces not less than one full mesh. Offset end laps to prevent continuous laps in either direction, and splice laps with tie wire.
- D. Exterior Concrete Slabs: All exterior slabs, walkways, driveways and pads shall be reinforced with wire fabric and placed over vapor barrier.

### 3.04 JOINT CONSTRUCTION

- A. Construction Joints: Locate and install construction joints as required by ACI and indicated on DBT drawings. If construction joints are not indicated, locate in manner which will not impair strength and will have least impact on appearance, as acceptable to the Architect. The surface of concrete construction joints shall be cleaned and laitance removed. Immediately before new concrete is placed, construction joints shall be wetted and standing water removed.
  - 1. Keyways: Provide keyways not less than 1-1/2 inches deep.
  - 2. Reinforcement: Continue reinforcement across and perpendicular to construction joints, unless details specifically indicate otherwise.
  - 3. Waterstops: Provide waterstops as indicated, installing to form continuous, watertight dam, with field joints fabricated in strict accordance with manufacturer's instructions. All waterstops shall be PVC and 6", unless noted otherwise.
- B. Control Joints: Construct contraction joints in slabs poured on grade to form panels of sizes indicated on drawings, but not more than 15 feet apart in either direction.
  - 1. Saw cuts: Form control joints by means of saw cuts one-fourth the depth of the slab, performed within 12 hours after slab finishing without dislodging aggregate.

### 3.05 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set anchorage devices and other items required for other work connected to or supported by cast-in-place concrete, using templates, setting drawings, and instructions from suppliers of items to be embedded.
  - 1. Edge Forms and Screeds: Set edge forms and intermediate screeds as necessary to achieve elevations indicated for finished slab surfaces.

### 3.06 CONCRETE PLACEMENT

- A. Inspection: Before beginning concrete placement, inspect form work, reinforcing steel, and items to be embedded, verifying that all such work has been completed.
  - 1. Wood forms: Moisten immediately before placing concrete in locations where form coatings are not used.
- B. Placement - General: Comply with requirements of ACI 304 and as follows:
  - 1. Schedule continuous placement on concrete to prevent the formation of cold joints.
  - 2. Provide construction joints if concrete for a particular element or component cannot be placed in continuous operation.
  - 3. Deposit concrete as close as possible to its final location, to avoid segregation.

- C. Placement in Forms: Limit horizontal layers to depths which can be properly consolidated, but in no event greater than 24 inches.
1. Consolidate concrete by means of mechanical vibrators, inserted vertical in freshly placed concrete in a systematic pattern at close intervals. Penetrate previously placed concrete to ensure that separate concrete layers are knitted together.
  2. Vibrate concrete sufficiently to achieve consistent consolidation without segregation of coarse aggregates. Do not use vibrators to move concrete laterally.
- D. Slab Placement: Schedule continuous placement and consolidation of concrete within planned construction joints. Thoroughly consolidate concrete without displacing reinforcement or embedded items, using internal vibrators, vibrating screeds, roller pipe screeds, or other means acceptable to Architect.  
Strike off and level concrete slab surfaces, using highway straightedges, darbies, or bull floats before bleed water can collect on surface. Do not work concrete further until finishing operations are commenced.

### 3.07 FINISHING FORMED SURFACES

- A. Repairs - General: Repair surface defects, including tie holes, immediately after removing form work.
1. Remove honeycombed areas and other defective concrete down to sound concrete, cutting perpendicular to surface or slightly undercutting. Dampen patch location and area immediately surrounding it prior to applying bonding compound or patching mortar.
  2. Before bonding compound has dried, apply patching mixture matching original concrete in materials and mix except for omission of coarse aggregate, and using a blend of white and normal portland cement as necessary to achieve color match. Consolidate thoroughly and strike off slightly higher than surrounding surface.
- B. Unexposed Form Finish: Repair tie holes and patch defective areas. Rub down or chip off forms or other raised areas exceeding 1/4 inch height.
- C. Exposed Form Finish: Repair and patch defective areas, with fins or other projections completely removed and smoothed.
1. Smooth rubbed finish: Apply to surfaces indicated no later than 24 hours after form removal.
    - a. Wet concrete surfaces to be finished and rub with Carborundum brick or other abrasive until uniform color and texture are achieved.
    - b. Do not apply separate grout mixture.
  2. Contiguous unformed surfaces: Strike smooth and float to a similar texture tops of walls, horizontal offsets, and other unformed surfaces. Continue final finish of formed surfaces across unformed surfaces, unless otherwise specifically indicated.
- D. SLOPE CONCRETE SLABS TO FLOOR DRAINS AS SHOWN ON THE DRAWINGS. Slab surfaces that are not properly sloped to floor drains (at least 1/8" per foot) will be required to be removed and replaced.

### 3.08 FINISHING SLAB

- A. Finishing Operations - General:
1. Do not directly apply water to slab surface or dust with cement.
  2. Use hand or powered equipment only as recommended in ACI 302.1R.
  3. Screeding: Strike off to required grade and within surface tolerances indicated. Verify conformance to surface tolerances. Correct deficiencies while concrete is still plastic.
  4. Bull Floating: Immediately following screeding, bull float or darby before bleed water appears to eliminate ridges, fill in voids, and embed coarse aggregate. Recheck and correct surface tolerances.
  5. Do not perform subsequent finishing until excess moisture or bleed water has disappeared and

- concrete will support either foot pressure with less than 1/4 inch indentation or weight of power floats without damaging flatness.
6. Final Floating: Float to embed coarse aggregate, to eliminate ridges, to compact concrete, to consolidate mortar at surface, and to achieve uniform, sandy texture. Recheck and correct surface tolerances.
  7. Trowel Finish: All slabs that receive resilient floor coverings shall be trowel finished.
- B. Coordinate appearance and texture of required final finishes with the Architect before application.
1. Apply final finishes in the locations indicated on the drawings.
- C. Float Finish: As specified above.
- D. Slab Surface Tolerances:
1. Achieve flat, level planes except where grades are indicated. **Slope uniformly to drains. Slabs that are not properly sloped to drains will be saw-cut, removed and re-poured to the satisfaction of the Architect.**
  2. Floated and trowel finishes: Depressions between high spots shall not exceed 1/8 inch under a 10-foot straightedge.
- E. Repair of Slab Surfaces: Test slab surfaces for smoothness and to verify surface plane to tolerance specified.
1. Repair defects as follows:
    - a. High areas: Correct by grinding after concrete has cured for not less than 14 days.
    - b. Low areas: Immediately after completion of surface finishing operations, cut out low areas and replace with fresh concrete. Finish repaired areas to blend with adjacent concrete.
    - c. Proprietary patching compounds may be used when approved by the Architect.
  2. Craze or cracked areas: Cut out defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts. Dampen exposed concrete and apply bonding compound. Mix, place, compact and finish patching concrete to match adjacent concrete.
  3. Isolated cracks and holes: Groove top of cracks and cut out holes not over 1 inch in diameter. Dampen cleaned concrete surfaces and apply bonding compound; place dry pack or proprietary repair compound acceptable to Architect while bonding compound is still active:
    - a. Dry-pack mix: one part portland cement to 2-1/2 parts fine aggregate and enough water as required for handling and placing.
    - b. Install patching mixture and consolidate thoroughly, striking off level with and matching surrounding surface. Do not allow patched areas to dry out prematurely.

### 3.09 CONCRETE CURING AND PROTECTION

- A. General:
1. Curing and protection in accordance with ACI 301 Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer, hardener, or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs.

2. Prevent premature drying of freshly placed concrete, and protect from excessively cold or hot temperatures until concrete has cured.
  3. Provide curing of concrete by one of the methods listed and as appropriate to service conditions and type of applied finish in each case.
- B. Curing Period:
1. Not less than 7 days for standard cements and mixes.
- C. Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed.
1. Keep wooden or metal forms moist when exposed to heat of the sun.
  2. If forms are removed prior to completion of curing process, continue curing by one of the applicable methods specified.
- D. Surfaces Not in Contact with Forms:
1. Start curing as soon as free water has disappeared, but before surface is dry. Place to protect adjacent concrete edges. Acceptable curing methods:
    - a. Water ponding.
    - b. Water-saturated sand.
    - c. Water-fog spray.
    - d. Saturated burlap: provide 4-inch minimum overlap at joints.
    - e. Moisture-retaining cover: Lap not less than 3-inches at edges and ends, and seal with waterproof tape or adhesive. Repair holes or tears during curing period with same tape or adhesive. Maintain covering in intimate contact with concrete surface. Secure to avoid displacement.
      1. Extend covering past slab edges at least twice the thickness of the slab.
      2. Do not use plastic sheeting on surfaces which will be exposed to view when in service.
      3. Curing compound: Apply at rate stated by manufacturer to conform with moisture-retention requirements specified, using second, immediate application at right angles to first, if necessary, and reapply if damaged by rain.
      4. Curing and sealing compound: Apply at rate stated by manufacturer to conform with moisture-retention requirements specified, using second, immediate application at right angles to first, if necessary, and reapply if damaged by rain. Apply additional coat near substantial completion to act as sealer.
      5. Use curing compounds only in locations permitted or required. Do not apply to surfaces to receive other finishes, coating, or coverings.
- E. Avoid rapid drying at end of curing period.

### 3.10 REMOVAL OF FORMS AND SUPPORTS

- A. Non-Load-Bearing Form Work: Provided that concrete has hardened sufficiently that it will not be damaged, forms not actually supporting weight of concrete or weight of soffit forms may be removed after concrete has cured at not less than 50 degrees F for 24 hours. Maintain curing and protection operations after form removal.

### 3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Fill-in: Fill in holes and openings left in concrete structures for passage of work by other trades after

such work is in place. Place such fill-in concrete to blend with existing construction, using same mix and curing methods.

- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as indicated on drawings. Set anchor bolts at correct elevations, complying with diagrams or templates of equipment
- C. Manufacturer.
  - 1. Grout base plates and foundations as indicated with nonshrink grout.
  - 2. Use nonmetallic grout for exposed conditions, unless otherwise indicated.

### 3.12 CONCRETE REPAIRS

- A. Perform cosmetic repairs of concrete surfaces as specified under concrete application.
- B. Perform structural repairs with prior approval of the Architect for method and procedure, using epoxy bonding systems. The Architect's approval is required for repair methods using materials other than those specified.

### 3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Concrete: Composite Sampling and Making and Curing of Specimens: ASTM C 172 and ASTM C 31.
  - 1. Take samples at point of discharge.
  - 2. For pumped concrete, perform sampling and testing at the frequencies specified herein at point of delivery to pump, and perform additional sampling and testing at the same frequency at discharge from line. Results obtained at discharge from line shall be used for acceptance of concrete.
- B. Slump: ASTM C 143. One test per strength test and additional tests if concrete consistency changes. Modify sampling to comply with ASTM C 94.
- C. Air Content of Normal Weight Concrete: ASTM C 173 or ASTM C 231. One test per strength test performed on air-entrained concrete.
- D. Concrete Temperature:
  - Test each time a set of strength test specimens is made.
- E. Compressive Strength Tests: ASTM C 39.
  - 1. Compression test specimens: Mold and cure one set of 4 standard cylinders for each compressive strength required.
  - 2. Testing for acceptance of potential strength of as-delivered concrete:
    - a. Obtain samples on a statistically sound, random basis.
    - b. Minimum frequency:
      - 1. One set per 25 cubic yards or fraction thereof for each day's pour of each concrete class.
      - 2. When the above testing frequency would provide fewer than 5 strength tests for a given class of concrete during the project, conduct testing from not less than 5 randomly selected batches, or from each batch if fewer than five.
  - 3. Test one specimen per set at 7 days for information unless an earlier age is required.
  - 4. Test 2 specimens per set for acceptance of strength potential; test at 28 days unless other age is specified. The test result shall be the average of the two specimens. If one specimen



- shows evidence of improper sampling, molding, or testing, the test result shall be the result of the remaining specimen; if both show such evidence, discard the test result and inform the Architect. Retain one specimen from each set for later testing, if required.
5. Strength potential of as-delivered concrete will be considered acceptable if all of the following criteria are met.
    - a. No individual test result falls below specified compressive strength by more than 500 psi. Not more than 10 percent of individual test results fall below specified compressive strength ( $f'c$ ).
    - b. Average of any 3 consecutive strength test results equals or exceeds specified compressive strength ( $f'c$ ).
  6. Evaluate construction and curing procedures and implement corrective action when strength results for field-cured specimens are less than 85 percent of test values for companion laboratory-cured specimens.
  - J. Removal of forms or supports: Mold additional specimens and field-cure with concrete represented; test to determine strength of concrete at proposed time of form or support removal.
- F. Test Results: Testing agency shall report test results in writing to Architect and contractor within 24 hours of test.
1. Test reports shall contain the following data:
    - a. Project name, number, and other identification.
    - b. Name of concrete testing agency.
    - c. Date and time of sampling.
    - d. Concrete type and class.
    - e. Location of concrete batch in the completed work.
    - f. All information required by respective ASTM test methods.
  2. Nondestructive testing devices such as impact hammer or sonoscope may be used at Architect's option for assistance in determining probable concrete strength at various locations or for selecting areas to be cored, but such tests shall not be the sole basis for acceptance or rejection.
  3. The testing agency shall make additional test of in-place concrete as directed by the Architect when test results indicate that specified strength and other concrete characteristics have not been attained.
    - a. Testing agency may conduct tests of cored cylinders complying with ASTM C 42, or tests as directed.
    - b. Cost of additional testing shall be borne by the contractor when unacceptable concrete has been verified.
- G. Grout: Test grout compressive strength per ASTM C 1019 for each 2000 square feet of wall area or portion thereof.

END OF SECTION 03 30 00

## SECTION 04 20 00 - CONCRETE MASONRY

### PART 1 - GENERAL

#### 1.01 APPLICABLE CODES AND STANDARDS

- A. Florida Building Code – 2020 Edition.  
2016 Masonry Standard Joint Committee's (MSJC) Book - Building Code Requirements and Specification for Masonry Structures, Containing TMS 402/ACI 530/ASCE 5, TMS 602/ACI 530.1/ASCE 6, and Companion Commentaries Building Code Requirements for Masonry Structures (ACI 530-13 / TMS 402-16).

#### 1.02 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General, Supplementary, and Special Conditions and Division 1 specification sections, apply to work of this section.

### PART 2 - PRODUCTS

#### 2.01 CONCRETE MASONRY UNITS

##### A. STANDARD WEIGHT CONCRETE MASONRY UNITS

1. Conform to ASTM C90-01a, grade "N", Type II, Aggregate is to be gravel, air-cooled blast furnace slag, or crushed stone. Units are to be acceptable visually, structurally, and free from undesirable defects resulting from either manufacturer or handling, as judged by ARCHITECT.
2. The minimum design compressive strength of the masonry,  $f'm = 2000$  psi minimum (2000 PSI on net area). Verify specified compressive strength of masonry using the "Unit Strength Method" of TMS MSJC. Submit calculations and certifications of unit and mortar strength.
3. Units which have not been subjected to an approved method of steam curing must be stored for 30 days prior to use.
4. Sound transmission loss through 4" unpainted unplastered wall, must not measure less than 36 decibels.
5. Linear drying shrinkage must not be greater than 0.04% when tested as prescribed by National Bureau of Standards.
6. Moisture content at time of delivery must not exceed 75% of relative humidity, as measured by approved methods of Portland Cement Association.
7. Standard brick sized units are to be solid, but otherwise conform to these paragraphs.
8. Deliver, store, handle, and protect material to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.
9. Store steel reinforcing bars, coated anchors, ties, and joint reinforcement above the ground. Maintain steel reinforcing bars and uncoated ties free of loose mill scale and loose rust.
10. Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands. Store cementitious material in dry, weathertight enclosures or completely cover. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Store sand and aggregates in a manner to prevent contamination and segregation.

##### B. ACCESSORY UNITS

1. 8"/12" x 16" x 8" thick header block at locations indicated.
2. 8"/12" x 16" knock out cut-lintel units, thickness as indicated.
3. Furnish regular corner, half, and half corner units; and all lintel and half block units as required by conditions shown on architectural and structural drawings.

#### 2.02 GROUT MATERIALS

- A. General and 03 30 00/Cast-In-Place Concrete.
- B. Water-reducing admixtures that conform to ASTM C494/C494M Type F or G and viscosity-modifying admixtures that conform to ASTM C494/C494M Type S are permitted for use in grout. In cold weather, a non-chloride based accelerating admixture may be used subject to approval by the DBT; use accelerating admixture that is non-corrosive and conforms to ASTM C494/C494M, Type C.
- C. Use grout that conforms to ASTM C476, fine. Use conventional grout with a slump between 8 and 11 inches. Use self-consolidating grout with slump flow of 24 to 30 inches and a visual stability index (VSI) not greater than 1. Provide minimum grout strength of 3000 psi in 28 days, as tested in accordance with ASTM C1019. Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that grout meets the specified requirements. Use ready-mixed grout that conforms to ASTM C476.

## 2.07 MORTAR PREPARATION

- A. Conform to ASTM C270 for procedures. Proportion as Florida Building Code, Type N, for concrete masonry, use a one bag mix as follows:
  - 3 bags high strength masonry cement
  - 13.5 – 5 gallon buckets sand.

## 2.08 PRECAST LINTELS

- A. High strength precast and pre-stressed concrete lintels designed to be used unfilled or filled to form a composite reinforced concrete beam using concrete masonry units equal to 'Cast-Crete'. Calculations for lintels shall be prepared by the Specialty Engineer and submitted to the Architect and Engineer for review if deviation from the Construction Documents.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Conform to referenced codes.
- B. No wetting of concrete masonry units is permitted. All openings in walls to have concrete-filled reinforced lintels, unless otherwise indicated on drawings.
- C. COVER INCOMPLETE WORK DAILY AND AS REQUIRED TO PROTECT FROM RAIN AND DUST.

### 3.02 COURSING AND JOINTING

- A. Concrete Masonry - Lay all units plumb and true to line, with uniform 3/8" joints, and in running bond. Joints wider than 3/8" will be rejected. Lay to course out at 8 inch centers.
- B. Strike all joints flush, after mortar has partially set, and sack or float walls head joints to give smooth uniform appearance and tool all horizontal joints concave where walls are to be left exposed. At stucco or hard tile locations delete tooling of joints.

### 3.03 LAYING MASONRY UNITS

- A. For bonding masonry to concrete foundation or floor slabs, concrete to be clean with laitance removed and aggregate exposed.
- B. Lay starting joint with full mortar coverage on the joint; except that areas where grout occurs are to

be free of mortar so that grout will contact concrete.

- C. Units shall be laid to preserve vertical continuity of cells to be filled. The vertical alignment shall be sufficient to maintain a clean, unobstructed flue measuring not less than 3"x3". Place no units or cut pieces of masonry less than 4" nominal.
- D. In placing mortar in horizontal joints, completely cover the face shells of each unit with mortar. Solidly fill all head joints to the thickness of the face shell and shove units tightly in place. Solidly bed in mortar all head and cross web bed joints adjacent to cells to be grouted to prevent leakage of mortar.
- E. Lay designated walls in two separate wythes, with insulated cavity as indicated.
- F. Anchor and bond intersecting masonry walls with 50% masonry bond, except as noted otherwise on drawings.
- G. Install precast and/or composite steel lintels over all openings (if required). Set lintels in place with joints pointed to match adjacent work. Build in lintels, reinforce and fill with structural concrete grout as work progresses.
  - 1. Steel lintels shall be provided with 6" minimum structural bearing each side of openings. All exterior lintels shall be hot dip galvanized prior to installation.
  - 2. Pre-cast concrete lintels shall be provided with 8" minimum structural bearing each side of openings.
  - 3. Typical steel and cut masonry lintels, even if not shown on structural or architectural drawings, shall be reinforced with a minimum of 2 #5 bar continuous (extend 12" minimum each end) and grouted solid.
  - 4. Concrete masonry work shall not proceed beyond the elevation of door and window headers until all vertical reinforced cells and reinforced horizontal lintels have been grouted.
- H. At hard tile locations take extra care in laying units such that wall will be suitable for thinset tile installation directly to wall. Grind any unevenness judged unacceptable by ARCHITECT.
- I. Install wall control/expansion joints at 20 ft. O.C. and/or as shown and detailed on architectural/engineering drawings.

### 3.04 CUTTING

- A. Do all cutting of block with carborundum or equivalent saw. To facilitate proper coursing, half blocks may be used to reduce amount of cutting. No masonry will be permitted to be used if not cut properly. Masonry broken by "blows" will be replaced, even if found after the wall has been completed.

### 3.05 PLACING STEEL REINFORCEMENT

- A. Reinforcing steel to be straight, except for bends around corners and as detailed otherwise on drawings. Lap reinforcing steel 48 bar diameters minimum. Place vertical bars in exact center of cells, or as otherwise indicated, and hold in position at top and bottom and at intervals not to exceed 96 bar diameters. Vertical cavity rebar to be run in maximum possible lengths, 5'-0" minimum, using low lift grouting procedures.
- B. Completely embed joint reinforcement in mortar or grout. Lap splices 6 inches minimum at all locations.
- C. Lap dowels in footings to vertical steel in masonry columns by placing in aligned cells, then grouting cells to obtain bonded lap between wall and footings.

D. Reinforce and grout all walls, as wall is built-up.

### 3.06 PLACING GROUT

- A. Insure all walls are cured minimum of three (3) days, and are solid, or braced against movement, during grouting. No one is to "walk" the walls. Notify DBT minimum of 24 hours or one full working day before start of each grouting operation.
- B. CONTRACTOR is to use only low-lift grouting procedure unless otherwise authorized by ARCHITECT and OWNER.
  - 1. Grout lifts that exceed 5'-0" must have prior approval of the OWNER. Contractor shall neatly saw-cut cleanout/inspection holes or provide manufactured inspection blocks at the bottom of all reinforced vertical cells for grout lifts greater than 5'-0".
- C. Grouting of reinforced vertical cells shall occur at intervals to allow grouting of all composite steel and/or precast lintels. Concrete masonry shall not be installed above lintels prior to grouting of all lintels.
- D. Consolidate all grout at time of pouring by puddling or vibrating and then reconsolidate by again puddling later before plasticity is lost. Stop grout pour 1 1/2" below top unit to form construction joint for subsequent pours. Neatly sawcut and provide cleanout/inspection hole at the bottom of all cells to be filled with grout when pour, if authorized, exceeds 5'-0" in height.
- E. CONTRACTOR has sole responsibility of completing masonry and grouting operations necessary to construct a sound load-bearing crack-free wall.
- F. Properly cure grout placed in horizontal reinforced precast concrete lintels minimum seven (7) days.

3.07 All masonry walls, if not receiving a formed and poured concrete beam at top and even if not shown on structural or architectural drawings, are to receive, as a minimum, a top knockout lintel block course reinforced with 2 #5 bar continuous and filled with concrete grout.

### 3.08 WATERPROOFING

- A. Refer to Division 7 for waterproof coating installed over concrete and masonry surfaces behind face veneer and elsewhere.
- B. Masonry CONTRACTOR is responsible for providing a uniformly regular surface prior to application of coating, with full and tight joints between concrete block units and around all brick ties or other embedded items. Remove projecting mortar and fill all joints and voids.

### 3.09 HOT WEATHER PROCEDURES

- A. When ambient air temperature exceeds 38 degrees C 100 degrees F, or exceeds 32 degrees C 90 degrees F and the wind velocity is greater than 13 km/h 8 mph, comply with TMS MSJC Article 1.8 D for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

### 3.09 COLD WEATHER PROCEDURES

- A. When ambient temperature is below 4 degrees C 40 degrees F, comply with TMS MSJC Article 1.8 C for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

### 3.10 TESTING AGENCY SERVICES:

- A. Testing agency by the Owner "Bay County" to perform specified tests and other services required for quality assurance. This includes verification of reinforcement steel placement, grout strength, and as required by TMS. At minimum grout shall be tested for first 16 CY, then for every 24 CY fraction. Test grout as required by ASTM methods. Provide 28 day compressive strength and slump results.

END OF SECTION 04 20 00

## STRUCTURAL INSPECTION PLAN

### PART 1

#### 1.01 SCOPE OF WORK

THIS PLAN DESCRIBES WORK REQUIRED TO COMPLY WITH THE THRESHOLD LAW; CHAPTER 553 OF THE FLORIDA STATUTES. THE OWNER SHALL RETAIN A QUALIFIED SPECIAL INSPECTOR TO PERFORM THE WORK DESCRIBED HEREIN. PROPOSALS FOR SPECIAL INSPECTION SERVICES SHALL BE SEPARATE AND INDEPENDENT FROM ALL OTHER PROPOSALS FOR MATERIALS TESTING AND OTHER QUALITY ASSURANCE SERVICES. THE SPECIAL INSPECTOR SHALL VERIFY THAT THE PRIMARY STRUCTURAL FRAME (ALL THOSE MEMBERS WHICH TRANSMIT LOADS TO THE GROUND) IS CONSTRUCTED IN SUBSTANTIAL ACCORDANCE WITH THE PERMITTED OFFICIAL CONTRACT DOCUMENTS, EXCEPT AS VARIATIONS THERE FROM ARE PERMITTED IN WRITING BY THE STRUCTURAL ENGINEER OF RECORD. THIS PLAN MAY BE SUPPLEMENTED BY ADDITIONAL REQUIREMENTS OF THE MUNICIPALITY OR BY THE OWNER AS DEEMED NECESSARY DURING THE COURSE OF THE WORK. THE OFFICIAL CONTRACT DOCUMENTS ARE DEFINED AS THE PERMITTED PLANS, RECORDED ADDENDA, PROJECT SPECIFICATIONS, AMENDMENTS AND THE STRUCTURAL INSPECTION PLAN.

#### 1.02 QUALIFICATIONS OF THE SPECIAL INSPECTOR

- A. THE SPECIAL INSPECTOR SHALL BE A FLORIDA REGISTERED ENGINEER EXPERIENCED IN STRUCTURAL ENGINEERING AND CERTIFIED AS REQUIRED BY CURRENT LEGISLATION. THE SPECIAL INSPECTOR MAY SEND A FULL-TIME EMPLOYEE AS HIS AUTHORIZED REPRESENTATIVE TO THE PROJECT, BUT THAT PERSON SHALL BE EXPERIENCED AND KNOWLEDGEABLE IN THE STRUCTURAL SYSTEMS BEING USED AND THE APPROPRIATE PORTIONS OF THE GOVERNING CODES AND STANDARDS.
- B. THE SPECIAL INSPECTOR SHALL HAVE A MINIMUM OF SEVEN (7) YEARS OF EXPERIENCE IN DESIGN AND INSPECTION OF SIMILAR STRUCTURES. THE SPECIAL INSPECTOR'S REPRESENTATIVE SHALL HAVE A MINIMUM OF THREE (3) YEARS OF EXPERIENCE IN INSPECTION OF SIMILAR STRUCTURES. RESUMES OF BOTH THE SPECIAL INSPECTOR AND SPECIAL INSPECTOR'S REPRESENTATIVE SHALL BE SUBMITTED TO THE OWNER'S REPRESENTATIVE, THE ENFORCING AGENCY HAVING JURISDICTION AND THE STRUCTURAL ENGINEER OF RECORD FOR REVIEW AND ACCEPTANCE. AS USED HEREIN THE TERM SPECIAL INSPECTOR INCLUDES THE AUTHORIZED REPRESENTATIVE, UNLESS OTHERWISE INDICATED. INsofar AS POSSIBLE, THE SPECIAL INSPECTOR SHALL NOT BE CHANGED THROUGHOUT THE DURATION TO THE PROJECT.

#### 1.03 RESPONSIBILITIES AND LIMITATIONS OF THE SPECIAL INSPECTOR

- A. THE SPECIAL INSPECTOR IS RESPONSIBLE TO THE ENFORCING AGENCY HAVING JURISDICTION FOR THIS PROJECT. THE PRESENCE OF THE SPECIAL INSPECTOR DOES NOT RELIEVE THE ENFORCING AGENCY, THE ARCHITECT OR THE STRUCTURAL ENGINEER OF RECORD OF THEIR RESPONSIBILITIES.
- B. PRIOR TO STARTING WITH THE WORK, THE SPECIAL INSPECTOR AND THE AUTHORIZED REPRESENTATIVE SHALL BECOME FAMILIAR WITH THE SPECIFIC STRUCTURAL COMPONENTS AND SYSTEMS WHICH THE SPECIAL INSPECTOR

- WILL BE RESPONSIBLE FOR INSPECTING. HE IS RESPONSIBLE FOR A THOROUGH KNOWLEDGE OF THE INTENT AND CONTENT OF THE CONTRACT DOCUMENTS AND ACCEPTED SUBMITTALS RELATING TO HIS INSPECTION RESPONSIBILITIES, APPROPRIATE PORTIONS OF THE GOVERNING CODES, AND THE EXERCISE OF GOOD JUDGMENT.
- C. THE SPECIAL INSPECTOR SHALL THEN PROVIDE A CERTIFIED AFFIDAVIT TO THE OWNER AND STRUCTURAL ENGINEER OF RECORD ATTESTING TO THE FOLLOWING:
1. HE HAS REVIEWED THE CONTRACT DOCUMENTS AND UNDERSTANDS THEIR CONTENT AND THE CONCEPT CONVEYED THEREIN.
  2. HE HAS READ THE STRUCTURAL INSPECTION PLAN, UNDERSTANDS ITS INTENT AND INTENDS TO COMPLY WITH ITS REQUIREMENTS.
- D. THE SPECIAL INSPECTOR IS RESPONSIBLE FOR OBSERVING THE CONSTRUCTION OF THE PRIMARY STRUCTURAL COMPONENTS AND REPORTING TO THE CONCERNED PARTIES THAT THOSE PORTIONS OF THE STRUCTURE ARE BEING BUILT IN GENERAL CONFORMANCE WITH THE STRUCTURAL DOCUMENTS, AND IF NOT, THE LOCATION AND DESCRIPTIONS OF THOSE VARIATIONS.
- E. THE SPECIAL INSPECTOR IS NOT TO MAKE DESIGN DECISIONS OR INTERPRETATION OF THE CONTRACT DOCUMENTS.
- F. THE SPECIAL INSPECTOR SHALL COOPERATE WITH THE CONTRACTOR BUT SHALL NOT DIRECT THE CONTRACTOR'S WORK NOR BE RESPONSIBLE FOR CONSTRUCTION MEANS AND METHODS.

#### 1.04 REPORTING

- A. THE SPECIAL INSPECTOR SHALL MAINTAIN A RECORD OF THE PROGRESS, WORKING CONDITIONS, OBSERVATIONS, TESTING, ANY REQUIRED ACTION BY THE CONTRACTOR, AND DEVIATIONS FROM THE OFFICIAL CONTRACT DOCUMENTS. SUCH RECORDS ARE TO BE KEPT BY THE SPECIAL INSPECTOR FOR A MINIMUM OF 3 YEARS AFTER COMPLETION OF THE PROJECT.
- B. IT IS THE DUTY OF THE SPECIAL INSPECTOR TO IMMEDIATELY NOTIFY THE CONTRACTOR IN PERSON, AND THE ARCHITECT AND STRUCTURAL ENGINEER OF RECORD BY TELEPHONE, OF THE FOLLOWING:
1. THE USE OF MATERIALS, TESTS, EQUIPMENT, WORKMANSHIP OR CONSTRUCTION NOT CONFORMING TO THE OFFICIAL CONTRACT DOCUMENTS.
  2. CONSTRUCTION PERFORMED WITHOUT INSPECTION AND NOT CAPABLE OF BEING INSPECTED OR TESTED IN PLACE.

THESE EXCEPTIONS SHALL THEN BE ISSUED IN WRITING IMMEDIATELY TO THOSE LISTED ABOVE AND ATTACHED TO THE DAILY FIELD REPORTS.

- C. THE SPECIAL INSPECTOR SHALL KEEP AN EXCEPTION FILE FOR FOLLOW-UP. THIS FILE SHALL BE REVIEWED ON A DAILY BASIS AND UPDATED AS EXCEPTIONS ARE RECTIFIED. ANY UNCORRECTED EXCEPTIONS SHALL BE REPORTED AT AN APPROPRIATE TIME, USING A NON-COMPLIANCE NOTICE, TO



- THE CONTRACTOR, ENFORCING AGENCY, OWNER'S REPRESENTATIVE AND ARCHITECT/ENGINEER.
- D. THE SPECIAL INSPECTOR SHALL WRITE AND SIGN A REPORT EACH DAY AN INSPECTION IS MADE. THE REPORT SHALL CONSIST OF THE FOLLOWING:
1. IDENTIFY NAME AND LOCATION OF PROJECT, NAME OF SPECIAL INSPECTOR AND SPECIAL INSPECTOR REPRESENTATIVE, PERMIT NUMBER, DATE, WORKING CONDITIONS INCLUDING WEATHER AND TEMPERATURE, AND TYPE AND LOCATION OF WORK BEING PERFORMED.
  2. A DETAILED REPORT OF EACH INSPECTION, INCLUDING THE PRESENCE AND ACTIVITIES OF THE TESTING AGENCY. NOTE CHANGES IN WORKING SEQUENCE OR MATERIALS AND ANY UNUSUAL CIRCUMSTANCES AFFECTING THE PERFORMANCE OF WORK. PLACE EMPHASIS ON THOSE AREAS WHERE DEFICIENCIES RECUR.
  3. REVIEW AND COMMENT ON THE MATERIALS TESTING REPORTS PRIOR TO THAT DAY'S INSPECTION.
- E. THE REPORT WILL BE SUPPLEMENTED WITH THE FOLLOWING, WHEN APPLICABLE:
1. SPECIAL RECORDS (WELD TESTS, WELDERS CERTIFICATES, CONCRETE TESTS, ETC.).
  2. INSPECTION REPORTS OF THE SHORING AND RE-SHORING ENGINEER.
  3. INSPECTION REPORTS OF THE GEOTECHNICAL ENGINEER.
  4. DOCUMENTATION OF CHANGES MADE IN THE FIELD.
  5. PHOTOGRAPHS.
- F. DAILY FIELD REPORTS SHALL BE SUBMITTED ON A WEEKLY BASIS TO THE ENFORCING AGENCY, OWNER'S REPRESENTATIVE, ARCHITECT AND STRUCTURAL ENGINEER OF RECORD, UNDER A COVER LETTER SIGNED AND SEALED BY THE SPECIAL INSPECTOR.
- G. AN INSPECTION LOG SUMMARIZING ALL INSPECTIONS SHALL BE POSTED AT THE JOBSITE AND FILLED OUT EACH DAY AN INSPECTION IS MADE. IT SHALL CONTAIN, AS A MINIMUM: PROJECT NAME, LOCATION, PERMIT NUMBER, SPECIAL INSPECTOR'S NAME, OWNER, CONTRACTOR, DATE OF INSPECTION, CONSTRUCTION PHASE, WORK DESCRIPTION, COMMENTS, APPROVED OR REJECTED AND BE SIGNED BY THE SPECIAL INSPECTOR.
- H. UPON COMPLETION OF THE BUILDING AND PRIOR TO THE ISSUANCE OF A CERTIFICATE OF OCCUPANCY, THE SPECIAL INSPECTOR SHALL SUBMIT TO THE ENFORCING AGENCY, OWNER, ARCHITECT AND STRUCTURAL ENGINEER OF RECORD A SIGNED AND SEALED STATEMENT STATING THAT THE PART OF THE PROJECT UNDER HIS INSPECTION RESPONSIBILITIES HAS BEEN CONSTRUCTED IN SUBSTANTIAL ACCORDANCE WITH THE OFFICIAL CONTRACT DOCUMENTS. THIS STATEMENT SHALL BE IN ACCORDANCE WITH SECTION 553.79(7)A OF THE FLORIDA STATUTES.

1.05 CONTRACTOR REQUIREMENTS

- A. THE CONTRACTOR SHALL COOPERATE WITH AND ASSIST THE SPECIAL INSPECTOR IN PERFORMING HIS INSPECTION DUTIES AS SPECIFIED HEREIN. THE SPECIAL INSPECTOR SHALL HAVE FREE ACCESS TO THE PROJECT AT ALL TIMES.
- B. THE CONTRACTOR SHALL ADVISE THE SPECIAL INSPECTOR, IN ADVANCE, OF CONSTRUCTION SCHEDULES AND PLANNED OPERATIONS IN ORDER TO ASSURE TIMELY AND APPROPRIATE OBSERVATION AND INSPECTION OF ITEMS SPECIFIED HEREIN. THE MINIMUM NOTICE GIVEN THE SPECIAL INSPECTOR SHALL BE 24 HOURS PRIOR TO THE TIME OF THE INSPECTION. FURTHER, THE SCHEDULED INSPECTION TIME FOR REINFORCING STEEL SHALL BE NOT LESS THAN ONE HOUR PRIOR TO THE SCHEDULED CONCRETE PLACEMENT.
- C. THE CONTRACTOR SHALL FURNISH IN A TIMELY MANNER TO THE SPECIAL INSPECTOR, COPIES OF ALL REVIEWED AND ACCEPTED SUBMITTALS (EXCLUDING CALCULATIONS) FOR THE STRUCTURAL ELEMENTS OF THE PROJECT.
- D. SPECIAL INSPECTIONS DO NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY TO COMPLY WITH THE CONTRACT DOCUMENTS, ANY STATUTORY OR CONTRACTUAL OBLIGATIONS, NOR HIS RESPONSIBILITIES TO CARRY OUT HIS QUALITY CONTROL INSPECTIONS AND TESTING. THE CONTRACTOR HAS THE SOLE RESPONSIBILITY FOR ANY DEVIATIONS FROM THE OFFICIAL CONTRACT DOCUMENTS AND THE COSTS OF RECTIFYING THOSE DEVIATIONS.
- E. WORK WHICH IS IN NON-COMPLIANCE WITH THE OFFICIAL CONTRACT DOCUMENTS MAY BE CORRECTED BY THE CONTRACTOR OR THE CONTRACTOR MAY SUBMIT TO THE ARCHITECT/ENGINEER A REQUEST FOR ACCEPTANCE OF THE DEVIATION.
- F. CONSTRUCTION PERFORMED WITHOUT INSPECTION AND THAT IS UNABLE TO BE INSPECTED MAY REQUIRE TESTING OR REMOVAL AS DETERMINED BY THE STRUCTURAL ENGINEER OF RECORD.
- G. THE SPECIAL INSPECTOR CAN NOT MAKE THE REQUIRED COMPLETION STATEMENT AND THE BUILDING WILL NOT RECEIVE A CERTIFICATE OF OCCUPANCY IF WORK IS NOT IN SUBSTANTIAL ACCORDANCE WITH THE OFFICIAL CONTRACT DOCUMENTS, OR IF CONSTRUCTION IS PERFORMED WITHOUT INSPECTION AND IS UNABLE TO BE INSPECTED.
- H. INSTALLATION OF ALL SHORING AND RE-SHORING SHALL BE IN ACCORDANCE WITH THE SIGNED AND SEALED SHORING AND RE-SHORING DRAWINGS PREPARED BY THE DELEGATED SHORING ENGINEER. (SEE STRUCTURAL NOTES FOR COMPLETE REQUIREMENTS). THE DELEGATED SHORING ENGINEER OR HIS AUTHORIZED REPRESENTATIVE SHALL INSPECT AND ENSURE THAT THE DRAWING REQUIREMENTS AND SPECIFICATIONS ARE ADHERED TO, AND PROVIDE HIS WRITTEN REPORT TO THE SPECIAL INSPECTOR PRIOR TO ALL CONCRETE POURS. THE SPECIAL INSPECTOR IS TO VERIFY THAT THE INSPECTION IS PERFORMED AND IS TO OBSERVE THAT THE WORK APPEARS TO BE IN COMPLIANCE WITH THE DRAWINGS.

1.06 REQUIREMENTS OF THE OWNER

- A. THE OWNER SHALL ARRANGE FOR ALL NECESSARY CONTRACT DOCUMENTS, INCLUDING TWO COMPLETE SETS OF ARCHITECTURAL AND STRUCTURAL DOCUMENTS FOR THE PROJECT, INCLUDING ALL DRAWINGS AND SPECIFICATIONS, THE GEOTECHNICAL REPORT AND MATERIALS TEST REPORTS, TO BE FURNISHED TO THE SPECIAL INSPECTOR DURING THE PROGRESS OF THE WORK IN A TIMELY MANNER. PROVIDE THE SPECIAL INSPECTOR WITH TWO COPIES OF ALL STRUCTURAL CHANGES, REVISIONS, ADDENDA, ETC.
- B. THE OWNER SHALL ENSURE THAT THE CONTRACTOR PROVIDES TO THE ENFORCING AGENCY, ARCHITECT, STRUCTURAL ENGINEER OF RECORD AND THE SPECIAL INSPECTOR A SHORING AND RE-SHORING PLAN WHICH IS SIGNED AND SEALED BY A DELEGATED ENGINEER REGISTERED IN THE STATE OF FLORIDA.
- C. THE OWNER SHALL ENSURE THAT A QUALIFIED TESTING AGENCY IS RETAINED. SEE CONTRACT DOCUMENTS FOR REQUIREMENTS.
- D. THE OWNER SHALL ENSURE THAT A GEOTECHNICAL CONSULTANT IS RETAINED TO CONFIRM THAT THE SPECIFIED FOUNDATION PREPARATION IS PERFORMED.

## PART II

### 2.01 GENERAL

THE FOLLOWING IS A GENERAL INSPECTION PLAN DESCRIBING WORK TO BE PERFORMED BY THE SPECIAL INSPECTOR. THE INTENT IS TO DESCRIBE MINIMUM LEVELS NECESSARY TO CONFIRM THAT WORK COMPLIES WITH THE DESIGN DOCUMENTS. THE FOLLOWING ARE NOT INSPECTOR CHECK LISTS BUT POINT OUT SOME CRITICAL AREAS REQUIRING SPECIFIC ATTENTION BY THE SPECIAL INSPECTOR.

### 2.02 FOUNDATIONS

#### A. SHALLOW FOUNDATIONS:

- 1. THE GEOTECHNICAL CONSULTANT RETAINED BY THE OWNER WILL INSPECT SHALLOW FOUNDATIONS AND ALL FOOTING AREAS TO CONFIRM THAT SPECIFIED DESIGN SOIL CAPACITIES ARE MET. THE GEOTECHNICAL CONSULTANT WILL FURNISH THE SPECIAL INSPECTOR WITH DAILY REPORTS AS WELL AS A SUMMARY REPORT, SIGNED AND SEALED BY A FLORIDA P.E., STATING THAT THE FOUNDATION PREPARATION WAS COMPLETED ACCURATELY AND COMPLETELY SO AS TO ALLOW THE FOUNDATION TO FUNCTION AS INTENDED.
- 2. THE TESTING AGENCY RETAINED BY THE OWNER WILL MONITOR AND TEST BACKFILL AND COMPACTION OPERATIONS. THE TESTING AGENCY WILL SUBMIT A COPY OF REPORTS ON THESE OPERATIONS TO THE SPECIAL INSPECTOR, SIGNED AND SEALED BY A FLORIDA P.E.

#### B. FOOTINGS:

- 1. REVIEW CONFIGURATION AND PLACEMENT OF REINFORCEMENT FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS. OBSERVE THAT CLEARANCES ARE PROPERLY MAINTAINED.

2. REVIEW DOWEL AND LAP SPLICE LENGTHS FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS.
3. OBSERVE CONCRETE PLACEMENT AS OUTLINED IN THE CAST-IN-PLACE CONCRETE SECTION OF THIS INSPECTION PLAN.

#### 2.03 CAST-IN-PLACE CONCRETE

- A. THE CONTRACTOR IS TO NOTIFY THE SPECIAL INSPECTOR A MINIMUM OF 24 HOURS PRIOR TO THE PLACEMENT OF ANY STRUCTURAL CONCRETE.
- B. REINFORCING STEEL:
  1. USING THE STRUCTURAL DRAWINGS, INSPECT GRADE, SIZE, QUANTITY, CONFIGURATION AND SPACING OF REINFORCING FOR COMPLIANCE WITH THE STRUCTURAL DRAWINGS SUPPLEMENTED WITH SHOP DRAWINGS. PRIOR TO CONCRETE PLACEMENT REPORT ANY NOTED CONFLICT AND CONFIRM THAT CORRECTIONS ARE MADE BEFORE CONCRETE IS POURED.
  2. CHECK MINIMUM CLEARANCE REQUIREMENTS FROM CONCRETE SURFACES.
  3. CHECK THAT REINFORCING IS ADEQUATELY SUPPORTED AND TIED TO RESIST DISPLACEMENT OR SHIFTING DURING POUR.
  4. CHECK THAT REBAR SURFACES ARE FREE OF EXCESS RUST OR OTHER COATINGS THAT MAY ADVERSELY AFFECT BONDING CAPACITY. IF OILING OF FORMS IS REQUIRED, CHECK THAT IT IS APPLIED BEFORE REINFORCING IS PLACED.
  5. CHECK SPLICE LOCATIONS AND REQUIRED LENGTH OF LAP. CHECK THAT THE ACCEPTED MECHANICAL COUPLERS ARE PROPERLY INSTALLED PER MANUFACTURER'S SPECIFICATIONS. REPORT ANY DEVIATIONS FROM THE CONTRACT DOCUMENTS BEFORE CONCRETE IS CAST AND CONFIRM THAT CORRECTIONS ARE MADE.
  6. CHECK INSTALLATION OF HOODED BARS FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS.

#### 2.04 STRUCTURAL STEEL

- A. INSPECT STRUCTURAL STEEL PRIOR TO CONCEALMENT TO VERIFY GRADE, SIZES, CONNECTIONS, STRAIGHTNESS AND FINISH. CHECK WITH CONTRACT DOCUMENTS AND SHOP DRAWINGS.
- B. INSPECT SETTING OF ANCHOR BOLTS, EMBEDS AND OTHER MISCELLANEOUS STRUCTURAL ITEMS PRIOR TO CONCRETING. VERIFY SIZE, QUANTITY AND FINISH.
- C. INSPECT CONNECTIONS FOR THE FOLLOWING:
  1. BOLTED CONNECTIONS: TYPE, SIZE AND NUMBER OF BOLTS. CHECK THAT BOLTS ARE CLEAN AND LUBRICATED AND HAVE PROPER WASHERS AND THAT THEY CONFORM TO THE SPECIFICATIONS. CHECK

THAT BOLT HOLES ARE THE SPECIFIED TYPE AND SIZE. VERIFY THAT BOLTS ARE PROPERLY TIGHTENED. FOR SLIP-CRITICAL BOLTS WITH LOAD INDICATOR WASHERS, CHECK ALL BOLTS VISUALLY AND 10% WITH A FEELER GAUGE. "TURN OF THE NUT" METHOD IS NOT ACCEPTABLE.

2. WELDED CONNECTIONS: VERIFY THAT WELDERS ARE AWS CERTIFIED FOR THE TYPE OF WELDS BEING MADE. VISUALLY EXAMINE ALL WELDS FOR TYPE, SIZE AND LENGTH FOR COMPLIANCE WITH THE STRUCTURAL DRAWINGS. VERIFY THAT REQUIRED NON-DESTRUCTIVE TESTING IS PERFORMED BY THE TESTING AGENCY. VERIFY THAT WELDS ARE CLEAN, FREE FROM SLAG, AND THAT RUST PROTECTION HAS BEEN APPLIED AS PER SPECIFICATIONS.

#### 2.05 LIGHT GAUGE FRAMING

THE SPECIAL INSPECTOR SHALL OBSERVE INSTALLATION TECHNIQUES OF EXTERIOR WALL LIGHT GAUGE ONLY. THIS WILL INCLUDE WORKMANSHIP, MEMBER SIZE, AND YIELD STRENGTH. INSPECTOR SHALL ENSURE ALL NECESSARY CONNECTIONS ARE INSTALLED FOR ALL LIGHT GAUGE FRAMING ELEMENTS.

### PART 3

#### 3.01 MATERIALS TESTING

ALL TESTING REQUIREMENTS AS DEFINED IN THE CONTRACT DOCUMENTS SHALL BE ADHERED TO, WITH COPIES OF RESULTS FORWARDED TO THE SPECIAL INSPECTOR. PRIOR TO EACH INSPECTION THE SPECIAL INSPECTOR SHALL REVIEW ALL MATERIAL TESTS AND REPORT ON THEIR RESULTS. THE SPECIAL INSPECTOR MAY REQUEST THE OWNER'S REPRESENTATIVE TO AUTHORIZE ADDITIONAL TESTS IF REQUIRED BY UNFORESEEABLE EVENTS OR CONDITIONS. ALL MATERIALS TESTING MUST BE EXECUTED BY QUALIFIED LABORATORIES AND TESTING FIRMS.

#### 3.02 SUBMITTALS

##### A. GENERAL:

CONTRACTOR MUST SUBMIT ONE COPY OF ALL STRUCTURAL SUBMITTALS (EXCLUDING CALCULATIONS) TO THE SPECIAL INSPECTOR FOR HIS RECORD AND USE. ALL SUBMITTALS SHALL BE REVIEWED AND ACCEPTED BY THE CONTRACTOR, ARCHITECT AND STRUCTURAL ENGINEER OF RECORD, AND SHALL CONTAIN APPROPRIATE EVIDENCE OF SUCH, PRIOR TO TRANSMITTING TO THE SPECIAL INSPECTOR.

##### B. THE SPECIAL INSPECTOR SHALL REVIEW AND BECOME FAMILIAR WITH ALL SUBMITTALS.

##### C. AS A MINIMUM THE FOLLOWING SHALL BE PROVIDED TO THE SPECIAL INSPECTOR:

###### 1. REINFORCING STEEL:

FABRICATION AND PLACEMENT DRAWINGS AND BAR LISTS.

###### 2. CONCRETE MIX DESIGNS:

COPIES OF CONCRETE MIX DESIGNS FOR ALL PROPOSED STRENGTHS  
AND GRADES.

3. STRUCTURAL STEEL:

FABRICATION AND ERECTION DRAWINGS FOR ALL STRUCTURAL STEEL  
COMPONENTS, MILL REPORTS FOR ALL STEEL, WELDER CERTIFICATES.

4. MISCELLANEOUS METALS:

FABRICATION AND ERECTION DRAWINGS FOR ALL STRUCTURAL  
METALS, SUCH AS EMBEDDED ANCHORS, CONNECTION PLATES,  
HANGERS, PRE-FABRICATED STEEL STAIRS, CATWALKS, ETC.

5. LIGHTGAGE FRAMING:

LIGHTGAGE FRAMING SHOP AND ERECTION DRAWINGS

D. ALTERNATES:

ALTERNATES WHICH ARE ACCEPTED SHALL BE PROVIDED TO THE SPECIAL  
INSPECTOR AS THEY BECOME AVAILABLE.

## SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

### 1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to work of this section.

### 1.02 SUMMARY:

- A. Extent of structural steel work is shown on drawings.
- B. Refer to Division 3 for anchor bolt installation in concrete.
- C. Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
  - 1. Promptly remove and replace materials or fabricated components which do not comply.

### 1.03 PERFORMANCE REQUIREMENTS:

- A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings and joint moments and shears indicated.
- B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.
- C. Design of Members: Details and members shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify all dimensions at the site prior to fabrication.

### 1.04 SUBMITTALS:

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified.
- C. Shop Drawings detailing fabrication of structural steel components.
- D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

### 1.05 QUALITY ASSURANCE:

- A. Installer Qualifications: Engage an experienced installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
  - 1. Work must be erected by an AISC Structural Steel Certified Erector, in accordance with AISC 207, Category CSE. Submit AISC Structural Steel erector quality certification.
- B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient

production capacity to fabricate structural steel without delaying the Work.

1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:
  - a. Work must be fabricated by an AISC Certified Structural Steel Fabricator, in accordance with AISC 207, Category BU. Submit AISC Structural Steel Fabricator quality certification.
  - b. Fabricator shall be registered with and approved by authorities having jurisdiction.
- C. Comply with applicable provisions of the following specifications and documents:
  1. AISC's "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design".
  2. AISC's "Specification for Allowable Stress Design of Single-Angle Members".
  3. ASTM A6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use".
  4. Research Council on Structural Connections (RCSC) "Specification for Structural Joints Using ASTM A325 or A4490 Bolts".
- D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the State of Florida jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.
- E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code - Steel". Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

#### 1.06 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS:

- A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.
- B. Structural Steel Shapes, Plates and Bars: ASTM A 36. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.



1. Formed Steel Tubing: ASTM A 501.
  2. Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501. Finish: Black, except where indicated to be galvanized.
  3. W-Shapes: ASTM A 572, Grade 50.
  4. Channels, Angles, M, S Shapes: ASTM A 572, Grade 50.
- C. Anchor Bolts: F1554 grade 55, non-headed type unless otherwise indicated.
- D. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low- carbon steel bolts and nuts.
1. Provide either hexagonal or square, heads or nuts, except use only hexagonal units for exposed connections.
- E. Electrodes for Welding: Comply with AWS Code.
- F. Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C621.

## 2.02 FABRICATION:

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
- B. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
- C. Connections: Weld or bolt shop connections, as indicated.
- D. Bolt field connections, except where welded connections or other connections are indicated.
1. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
- E. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" (RCRBSJ).
- F. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welder or welding operator is more than 6 months old, the welding operator's qualification certificate must be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months. Conform to all requirements specified in AWS D1.1/D1.1M.
- G. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
- H. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.
- I. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
- J. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by

burning. Drill holes in bearing plates.

## 2.03 SHOP PAINTING:

- A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.
1. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.
  2. Do not paint surfaces which are scheduled to receive sprayed-on fireproofing.
  3. Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- B. Surface Preparation: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
1. SP-6 "Commercial Blast Cleaning" for all steel in exterior walls.
  2. SP-3 "Power Tool Cleaning" for all other steel.
- C. Painting: Immediately after surface preparation, apply the following:
1. 1.5 mils DFT non-asphaltic primer complying with SSPC's "Painting System Guide No. 7.00".
- D. Apply paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than that specified. Use painting methods which result in full coverage of joints, comers, edges and exposed surfaces.

## PART 3 - EXECUTION

### 3.01 ERECTION:

- A. Surveys: Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.
- B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.
- C. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
- D. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
- E. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

- F. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
  - 1. For proprietary grout materials, comply with manufacturer's instructions.
- G. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- H. Level and plumb individual members of structure within specified AISC tolerances.
- I. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- J. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
- K. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
- L. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- M. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.
- N. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
- O. Apply by brush to provide minimum dry film thickness of 8.0 mils.

### 3.02 QUALITY CONTROL:

- A. Testing agency by the Owner "Bay County" to perform specified tests and other services required for quality assurance.
- B. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations there from.
- C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
- D. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specified requirements.
- E. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

- F. Shop Bolted Connections: Inspect or test in accordance with AISC specifications.
- G. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:  
Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
  - 1. Perform visual inspection of all welds.
- H. Field Bolted Connections: Inspect in accordance with AISC specifications.
- I. Field Welding: Inspect and test during erection of structural steel as follows:
  - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
  - 2. Perform visual inspection of all welds.

END OF SECTION 05 12 00

## **SECTION 05 31 00 - STEEL DECK**

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following:

- 1. Steel roof deck.

- B. Related Sections include the following:

- 1. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

### 1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.
- D. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
  - 1. Mechanical fasteners.
- E. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329-21 to conduct the testing indicated.
- C. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."
- D. FM Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire-rating and Class 1-90 windstorm ratings.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

## 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. Steel Deck:
    - a. ASC Profiles, Inc.: ASC Steel Deck.
    - b. Consolidated Systems, Inc.
    - c. Epic Metals Corporation.
    - d. Marlyn Steel Decks, Inc.
    - e. Nucor Corporation - Vulcraft Group.
    - f. Roof Deck, Inc.
    - g. United Steel Deck, Inc.
    - h. Verco Manufacturing Co.
    - i. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

### 2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with “SDI Specifications and Commentary for Steel Roof Deck,” in SDI Publication No. 29, and the following:
  - 1. Galvanized Steel Sheet: ASTM A 653/A653M-20, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
  - 2. Deck Profile: As indicated on drawings.
  - 3. Profile Depth: As indicated on drawings.
  - 4. Design Uncoated-Steel Thickness: As indicated on drawings.
  - 5. Span Condition: Triple span or more.
  - 6. Side Laps: Overlapped.

### 2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8 mm) minimum diameter.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- F. Galvanizing Repair Paint: ASTM A 780/A780M-20, SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- G. Repair Paint: Lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

### PART 3 – EXECUTION

#### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

#### 3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate decking bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

#### 3.3 ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members by screws of the surface diameter indicated on the structural drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 12 inches, and as follows:
  - 1. Mechanically fasten with self-drilling No. 10 (4.8-mm-) diameter or larger carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.
- D. Install piercing hanger tabs not more than 14 inches (355 mm) apart in both directions, within 9 inches (228 mm) of walls at ends, and not more than 12 inches (305 mm) from walls at sides, unless otherwise indicated.
- E. Miscellaneous Roof Deck Accessories: Install ridge plates, finish strips, cover plates, and closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

#### 3.4 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.
- B. Field welds will be subject to inspection.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

#### 3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M-20 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310



**SECTION 05 41 00 - PRE-ENGINEERED, PRE-FABRICATED LIGHT GAUGE STEEL  
ROOF TRUSSES**

1.1 SUMMARY

- A. Section includes pre-engineered, pre-fabricated light gauge cold formed steel framing elements. Work includes:
1. Light Gauge Cold formed steel roof trusses.
  2. Anchorage, bracing and bridging.
- B. Related work
1. Drywall attachment
  2. Roofing, fascia, soffit

1.2 REFERENCES

- A. Reference standards:
1. ASTM:
    - a. ASTM A653/A653M-20 "Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process."
    - b. ASTM A780/A780M-20 "Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings."
  2. American Welding Society (AWS)
    - a. AWS D1.1 "Structural Welding Code - Steel."
    - b. AWS D1.3 "Structural Welding Code - Sheet Steel."

1.3 PERFORMANCE REQUIREMENTS

- A. AISI "Specifications": Calculate structural characteristics of cold-formed steel truss members according to AISI Specification for the Design of Cold-Formed Steel Structural Members (2020).
- B. Structural Performance: Design, engineer, fabricate, and erect cold-formed steel trusses to withstand specified design loads within limits and under conditions required.
1. Design Loads: As specified on construction drawings.
  2. Deflections: Live load deflection meeting the following (unless otherwise specified):
    - a. Roof Trusses: Vertical deflection less than or equal to 1/240 of the span.
  3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120 deg F (67 deg C).

1.4 SUBMITTALS

- A. Submit manufacturer's product data and installation instructions for each type of cold-formed steel framing and accessory required.
- B. Submit shop drawings showing member, type, location, spacing, size and gage of members, method of attachment to supporting members and all necessary erection details. Indicate supplemental bracing, strapping, splices, bridging, accessories and details required for proper installation.
- C. Submit detailed roof truss layouts.

- D. Submit truss drawings and calculations, sealed and signed by a qualified State of Florida registered Professional Engineer, verifying ability of truss and truss connections to supports to meet local code and design requirements. Include:
1. Description of design criteria.
  2. Engineering analysis depicting member stresses and truss deflection.
  3. Truss member sizes and gauges and connections at truss joints.
  4. Truss support reactions and
  5. Attachment to supporting structure, including number of fasteners or amount of weld.
  6. Top chord, Bottom chord and Web bracing requirements.

#### 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Fabrication shall be performed by a cold-formed steel truss fabricator with experience designing and fabricating cold-formed steel truss systems equal in material, design, and extent to the systems required for this Project.
1. Cold Formed steel truss system installation shall be performed by an experienced installer.
- B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."
1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and erection.
- B. Store trusses on blocking, pallets, platforms or other supports off the ground and in an upright position sufficiently braced to avoid damage from excessive bending.
- C. Protect trusses and accessories from corrosion, deformation, damage and deterioration when stored at job site. Keep trusses free of dirt and other foreign matter.

#### 1.7 PROJECT CONDITIONS

- A. During construction, adequately distribute all loads applied to trusses so as not to exceed the carrying capacity of any one joist, truss or other component.

### 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. Allied Studco, Division of Allied Tube and Conduit.
  2. Allsteel and Gypsum Products, Inc.
  3. California Expanded Metal Products Company.
  4. ClarkWestern Building Systems.
  5. Consolidated Fabricators Corporation; Building Products Division.
  6. Craco Metal Manufacturing, Inc.
  7. Custom Stud, Inc.
  8. Design Shapes in Steel.

9. Dietrich Metal Framing, a Worthington Industries Company.
10. Nexframe, LP.
11. Innovative Steel Technologies, Inc.
12. MarinoWare; a division of Ware Industries.
13. Quail Run Building Materials, Inc.
14. SCAFCO Corporation.
15. Southeastern Stud & Components, Inc.
16. Steel Construction Systems.
17. Steeler, Inc.
18. Super Stud Building Products, Inc.

## 2.2 COMPONENTS

- A. System components: light gauge steel roof truss components.
- B. Provide manufacturer's standard steel truss members, bracing, bridging, blocking, reinforcements, fasteners and accessories with each type of steel framing required, as recommended by the manufacturer for the applications indicated and as needed to provide a complete light gauge cold formed steel truss system.
- C. Provide continuous plates along all ridges, valleys, hips, and as otherwise required for support of all edges of roof deck.

## 2.3 MATERIALS

- A. Materials:
  1. All component gauges: Fabricate components of structural quality steel sheet per ASTM A653/A653M-20 with a minimum yield strength of 40,000 psi.
  2. Bracing, bridging and blocking members: Fabricate components of commercial quality steel sheet per ASTM A653/A653M-20 with a minimum yield strength of 33,000 psi.
- B. Steel truss components: Provide sizes, shapes and gages required, except that the top chord shall be 18 ga. minimum in order to achieve the pullout values for the roof decking attachment, based on 48" truss spacing. If trusses are spaced less than 48", the deck fastening requirements may be reduced in accordance with recognized engineering design principles, subject to approval by EOR.
  1. Design Uncoated-Steel Thickness: 20 ga., 0.0350 inch (0.91 mm).
  2. Design Uncoated-Steel Thickness: 18 ga., 0.0460 inch (1.20 mm).
  3. Design Uncoated-Steel Thickness: 16 ga., 0.0570 inch (1.52 mm).
  4. Design Uncoated-Steel Thickness: 14 ga., 0.0730 inch (1.90 mm).
- C. Finish: Provide components with protective zinc coating complying with ASTM A653/A653M-20, minimum G60 coating.
- D. Fastenings:
  1. Manufacturer recommended self-drilling, self-tapping screws with corrosion-resistant plated finish. Fasteners shall be of sufficient size and number to ensure the strength of the connection.
  2. Welding: Comply with AWS D1.1 when applicable and AWS D1.3 for welding base metals less than 1/8" thick.
  3. Other fasteners as accepted by truss engineer.

## 2.4 FABRICATION

- A. Factory fabricate cold-formed steel trusses plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.
1. Fabricate truss assemblies in jig templates.
  2. Cut truss members by sawing or shearing or plasma cutting.
  3. Fasten cold-formed steel truss members by welding or screw fastening, or other methods as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to cold-formed steel truss component manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
- B. Care shall be taken during handling, delivery and erection. Brace, block, or reinforce truss as necessary to minimize member and connection stresses.
- C. Fabrication Tolerances: Fabricate trusses to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:
1. Spacing: Space individual trusses no more than plus or minus 1/8 inch (3mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
  2. Squareness: Fabricate each cold-formed steel truss to a maximum out-of-square tolerance of 1/8 inch (3mm).

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Examine structure, substrates and installation conditions. Do not proceed with cold-formed steel truss installation until unsatisfactory conditions have been corrected.
- B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

### 3.2 INSTALLATION, GENERAL

- A. General:
1. Erection of trusses, including proper handling, safety precautions, temporary bracing and other safeguards or procedures are the responsibility of the Contractor and Contractor's installer.
  2. Exercise care and provide erection bracing required to prevent toppling of trusses during erection.
- B. Erect trusses with plane of truss webs vertical and parallel to each other, accurately located at design spacing indicated.
- C. Provide proper lifting equipment suited to sizes and types of trusses required, applied at lift points recommended by truss fabricator. Exercise care to avoid damage to truss members during erection and to keep horizontal bending of the trusses to a minimum.
- D. Provide framing anchors as indicated or accepted on the engineering design drawing or erection drawings. Anchor trusses securely at bearing points.

- E. Install roof framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations.
  - 1. DO NOT cut truss members without prior approval of truss engineer.
  - 2. Fasten cold-formed steel roof framing by welding or screw fastening, as standard with fabricator. Wire tying of roof framing is not permitted.
    - a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to cold-formed roof framing Manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
    - c. Install roof framing in one-piece lengths, unless splice connections are indicated.
    - d. Provide temporary bracing and leave in place until trusses are permanently stabilized.
  
- F. Erection Tolerances: Install trusses to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:
  - 1. Space individual trusses no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

### 3.3 ROOF TRUSS INSTALLATION

- A. Install, bridge, and brace trusses according to manufacturer's recommendations and requirements of this Section.
- B. Space trusses as indicated on construction drawings.
- C. Do not alter, cut, or remove truss members or connections of truss members.
- D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacing indicated.
- E. Erect trusses without damaging truss members or connections.
- F. Align truss bottom chords with load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.
- G. Install continuous bridging and permanent truss bracing per truss design requirements.
- H. Install necessary roof cross and diagonal bracing per design professional recommendations.

### 3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanizing repair paint according to ASTM A 780/A780M20 and the manufacturer's instructions.

END OF SECTION 05410

## SECTION 05 50 00 - METAL FABRICATIONS

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

### 1.2 DESCRIPTION

- A. Definition: Metal fabrications includes items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.
- B. Types of work in this section include metal fabrications for:
  - Rough Hardware
  - Loose Bearing and Leveling Plates
  - Loose Steel Lintels
  - Miscellaneous Framing and Supports
  - Miscellaneous Steel Trim
  - Galvanized Exterior Nosings
  - Shelf Angles
  - Galvanized Steel Pipe Railings
  - Galvanized Steel Pipe Bollards
  - Access Doors and Panels

### 1.3 CODES AND STANDARDS

- A. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings"; AWS "Structural Welding Code", comply with applicable provisions unless otherwise indicated.

### 1.4 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible.

Do not delay job progress, allow for trimming and fitting where taking field measurement before fabrication might delay work.

- B. Shop Assembly: Preassemble items in ship to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

### 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

- B. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.
1. Whether materials or fabrications are indicated to comply with certain requirements for design loadings include structural computations, material properties and other information needed for structural analysis.
- C. Samples: Submit two (2) sets of representative samples of materials and finished products as may be requested by Architect.

## PART 2 - PRODUCTS AND MATERIALS

### 2.1 MATERIALS

- A. Metals:
1. General: provide and install miscellaneous steel shapes, angles, lintels, plates, brackets, channels, clip angles, connectors, and anchors. Back to back angles or other members consisting of two or more shapes shall be bolted together or welded.
  2. For fabrication of miscellaneous metal work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
  3. All exterior steel shall be hot dip galvanized prior to installation.
- B. Steel Plates, Shapes and Bars: ASTM A 36/A 36M-19.
- C. Steel Bar Grating: ASTM A1011 / A1011M-18a or ASTM A 36/A 36M-19.
- D. Steel Tubing: Cold formed, ASTM A 500/A 500M-21a; or hot-rolled, ASTM A 501/ A501M-21.
- E. Steel Pipe: ASTM A 53/ A53M-20, standard weight (Schedule 40).
- F. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- G. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47/ A47M-99(2018)e1 , or cast steel, ASTM A27/A27M-20. Provide bolts, washers and shims as required, hot-dip galvanized ASTM A153/A153M-16a.
- H. Sleeves: It is the intent that sleeves shall be provided in foundation walls, floors, and walls for plumbing, water, electrical, refrigeration lines and other equipment provided by other trades. Coordinate proper location of sleeves with trades involved.
- I. Access Doors and Panels: Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 16 gauge steel with welded joints and finished with anchorage for securing into construction. Access doors shall be sizes as indicated on the drawings and of not lighter than 14 gauge steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a flush face, screw driver operated latch. Exposed metal surfaces shall have a shop applied prime coat and be field painted.

- J. Handrails: Handrails shall be designed to resist a concentrated load of 200 pounds in any direction at any point of the top of the rail or 20 pounds per foot applied horizontally to top of the rail, whichever is more severe.

### 3.2 FASTENERS

- A. General: Provide all anchors, bolts and nails for fastening and anchoring all work. Provide hot-dipped galvanized fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.
1. Nails and bolts shall be galvanized.
- B. Bolts and Nuts: Regular hexagon head type, ASTM A 307-21, Grade A.
- C. Lag Bolts: Square head type, FS FF-B-561.
- D. Machine Screws: Cadmium plated steel, FS FF-S-111.
- E. Wood Screws: Flat head carbon steel, FS FF-S-111.
- F. Plain Washers: Round, carbon steel, FS FF-W-92.
- G. Masonry Anchorage Devices: Expansion shields, FS FF-S-325.
- H. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and type as required.
- I. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

### 3.3 PAINT

- A. Primer selected must be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Division 9.
- B. Galvanized Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel, complying the Military Specifications MIL-P-21035 (Ships).

## PART 3 - FABRICATION, GENERAL

### 3.1 MEASUREMENTS

- A. Take field measurements to verify all dimensions before final fabrication.
1. All miscellaneous steel and metal items shall be fabricated from new materials which are straight and free from blemishes. Joints shall be tight, accurately fitted, smooth and reinforced as necessary. Fabricate all work for connections, anchorage and bolt holes and supply with all incidentals required.
  2. Workmanship: Use materials of size and thickness indicated, or, if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.

### 3.2 FORMS



- A. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

### 3.3 WELDING CORNERS AND SEAMS

- A. Welding corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

### 3.4 EXPOSED CONNECTIONS

- A. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts.
- B. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- C. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

### 3.5 GALVANIZING

- A. Provide a zinc coating for those items shown on drawings or specified to be galvanized, as follows:
1. ASTM A153/A153M-16a for galvanizing iron and steel hardware.
  2. ASTM A 123/A 123M-17 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8" thick and heavier.
  3. ASTM A 123/A 123M-17 for galvanizing assembled steel products.

### 3.6 FABRICATION OF JOINTS

- A. Fabricate joints that will be exposed to weather in a manner of exclude water or provide weep holes where water may accumulate.

### 3.7 SHOP PAINTING

- A. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise indicated.
1. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 "Hand Tool Cleaning", or SSPC SP-3 "Power Tool Cleaning", or SSPC SP-7 "Brush -Off Blast Cleaning".
  2. Remove oil, grease and similar contaminants in accordance with SSC SP-1 "Solvent Cleaning".
  3. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at a rate to provide uniform dry film thickness in accordance with The Code of Standard Practice, A.I.S.C. latest edition. Use painting methods that will result in full coverage of joints, corners, edges and exposed surfaces.

4. Apply one (1) shop coat to fabricated metal items, except apply two (2) coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

### 3.8 MISCELLANEOUS FABRICATIONS

- A. Rough hardware: Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.
  1. Fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections, elsewhere, furnish steel washers.
- B. Nosings: Provide step nosings fabricated of structural steel shapes as shown, of all welded construction with mitered corners and continuously welded joints. Provide anchors welded to nosings for embedding in concrete construction, spaced not more than 6" from each end.
  1. Galvanized exterior nosings.
- C. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.
- D. Loose Steel Lintels: Provide loose structural steel lintels for openings and recesses in masonry walls and partitions as shown or detailed on drawings. Weld adjoining members together to form a single unit where indicated.
- E. Galvanized loose steel lintels to be installed in exterior walls.
- F. Shelf Angles: Fabricate to sizes shown for attachment to support framing. Galvanize shelf angles to be installed for exterior brick.
- G. Miscellaneous Framing and Supports: Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete the work.
  1. Fabricate miscellaneous units to size, shapes and profiles shown, or if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
    - a. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
    - b. Except as otherwise shown, space anchors 24" o.c. and provide minimum anchor units of 1 1/4" x 1/4" x 8" steel straps.
  2. Galvanize exterior miscellaneous frames and supports.
- H. Miscellaneous Steel Trim: Provide shapes and sizes for profiles shown. Except as otherwise indicated, fabricate units from structural steel shapes and plates and steel bars, with continuously

welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.

1. Galvanize exterior miscellaneous steel trim.
- I. Galvanized Steel Pipe Railings and Handrails: Fabricate galvanized steel pipe railings and handrails to design, dimensions, and details indicated. Provide railings and handrails members formed of pipe of sizes and wall thickness indicated, or if not shown, as required to support design loading.
1. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise specified.
    - a. At tee and cross intersections provide coped joints.
    - b. At elbow bends provide mitered joints.
  2. Provide wall returns at ends of wall-mounted handrails, except where otherwise indicated.
    - a. Close exposed ends of pipe by welding 3/16" thick steel plate in place or by use of prefabricated fittings.
  3. Brackets, Flanges, Fittings and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnection of pipe and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete masonry work.
    - a. For railing posts set in concrete provide sleeves of galvanized steel pipe not less than 8" long and with an inside diameter not less than 1/2" greater than the outside diameter of pipe. Provide galvanized steel plate closure welded to bottom of sleeve and of width and length not less than 1" greater than outside diameter of concrete.
    - b. Provide friction fit, removable covers designed to keep sleeves clean and hold top edge of sleeve 1/2" below finished surface of concrete.
  4. Galvanized steel pipe shall be 1-1/2" O.D., Schedule 40, ASTM A 53/A 53M-20, prime coat finish.

#### PART 4 - EXECUTION

##### 4.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

##### 4.2 INSTALLATION

- A. General: Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.
- B. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation,

- plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry or similar construction.
- C. Fit exposed connections accurately together to form tight hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shot paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- E. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- F. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with the edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink in exposed locations, unless otherwise indicated.
- G. Pack grout solidly between bearing surfaces and plates to ensure that no void remains.
- H. Galvanized Steel Pipe Railings and Handrails: Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
1. Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non-shrink, non-metallic grout, mixed and placed to comply with grout manufacturer's directions.
    - a. Cover anchorage joint with a round galvanized steel flange welded to post.
  2. Anchor rail ends into concrete and masonry with galvanized steel round flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.
- I. Removable Access Panels: A removable access panel not less than 12 inches by 12 inches shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would be otherwise not be accessible. Other access panels shall be as indicated on the drawings.
- 4.3 ADJUST AND CLEAN
- A. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. For galvanized surfaces: Clean field welds, bolted connections and abraded areas and apply 2 coats of galvanizing repair paint.

END OF SECTION 05500

## SECTION 06 10 00 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Rooftop equipment bases and support curbs.
  - 2. Wood blocking, cants, and nailers.
  - 3. Wood furring and grounds.
  - 4. Plywood backing panels.
  - 5. Wood bucks for openings in Insulated Concrete Forming System (ICF).
- B. Related Requirements:
  - 1. Section 06 16 00 "Sheathing."

#### 1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
  - 2. NLGA: National Lumber Grades Authority.
  - 3. SPIB: The Southern Pine Inspection Bureau.
  - 4. WCLIB: West Coast Lumber Inspection Bureau.
  - 5. WWPA: Western Wood Products Association.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Power-driven fasteners.
3. Powder-actuated fasteners.
4. Expansion anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal thickness or less, no limit for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D.
- E. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
  2. Nailers.
  3. Rooftop equipment bases and support curbs.
  4. Cants.
  5. Furring.
  6. Grounds.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine; No. 2 grade; SPIB.
  2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
  3. Eastern softwoods; No. 2 Common grade; NeLMA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.4 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

## 2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 .

- F. Bolts: Steel bolts complying with ASTM A 307, Grade A ; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 .

## 2.6 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
  - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- thickness.
  - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
  - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.



- G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. "Fastening Schedule," in Florida Building Code.
- J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### 3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

### 3.4 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

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## **SECTION 06 41 16 - ARCHITECTURAL CABINETS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Plastic-laminate-faced architectural cabinets.
  - 2. Solid-surfacing-material for all countertops with integral backsplashes.
  - 3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
- B. Related Requirements:
  - 1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

#### 1.3 PREINSTALLATION MEETINGS

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

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate and cabinet hardware and accessories.
  - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
- C. Samples for Initial Selection:
  - 1. Plastic laminates.
  - 2. Solid surface samples.
- D. Samples for Verification:
  - 1. Plastic laminates, 12 by 12 inches, for each type, color, pattern, and surface finish.

2. Corner pieces as follows:
  - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
  - b. Miter joints for standing trim.
3. Exposed cabinet hardware and accessories, one unit for each type and finish.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Product Certificates: For each type of product.
  1. High-pressure decorative laminate.
  2. Solid surfaces.
  3. Adhesives.

#### 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: .
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards Seventh Edition, Version 1.2, 1999" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements except as herein modified or as shown on the drawings, whichever is more stringent.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  1. Build mockups of typical plastic-laminate cabinets as shown on Drawings.
  2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## 1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Type of Construction: Face frame.
- B. Cabinet, Door, and Drawer Front Interface Style: Reveal overlay.
- C. Reveal Dimension: As indicated or if not indicated, 3/4".
- D. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- E. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- F. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued dovetail joints.
- G. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
  - 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. Abet Laminati, Inc.
    - b. Formica Corporation.
    - c. Lamin-Art, Inc.
    - d. Panolam Industries International, Inc.
    - e. Wilsonart International; Div. of Premark International, Inc. (Basis of Design)
  - 2. Laminate Cladding for Exposed Surfaces:
    - a. Horizontal Surfaces: Grade HGS.
    - b. Vertical Surfaces: Grade HGS.
    - c. Edges: Grade HGS.
    - d. Pattern Direction: Horizontally for doors, fixed panels, and drawer fronts.
  - 3. Materials for ALL Semi-Exposed Surfaces:
    - a. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
      - 1) Edges of Plastic-Laminate Shelves: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
      - 2) For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
    - b. Drawer Sides and Backs: Solid-hardwood lumber.
    - c. Drawer Bottoms: Hardwood plywood.
  - 4. Laminate Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

- H. Basis of Design Product: All Cabinets (except as noted) PL-1 - Wilsonart
- I. Subject to compliance with requirements, provide product where indicated on Drawings:
  - a. Wilsonart – Columbian Walnut (7943)
  - b. Finish: Textured Gloss Finish with AEON 7943K-07
  - c. Install cabinets with the wood grain running horizontally on both the lower and the upper cabinets.

## 2.2 COUNTERTOPS AND BACKSPLASHES

- A. ALL COUNTERTOPS AND BACKSPLASHES: Basis of Design Product: DuPont Corian.
- B. Countertops and Backsplashes -**Solid-Surfacing Material**: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
  - 1. 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:
    - a. Avonite, Inc.
    - b. E. I. du Pont de Nemours and Company.
    - c. Formica Corporation.
    - d. LG Chemical, Ltd.
    - e. Nevamar Company, LLC; Decorative Products Div.
    - f. Wilsonart International; Div. of Premark International, Inc.
    - g. Corian Solid Surface (Basis of Design)
  - 2. Type: Standard type or veneer type made from material complying with requirements for Standard type, as indicated, unless Special Purpose type is indicated.
- C. Solid-Surfacing-Material Minimum Thickness: 1/2 inch.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
  - 1. Solid Surface Countertops SS-1 (Breakroom #2-15) - Sparkling White
- E. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturers written recommendations for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate tops with shop-applied edges of materials and configuration indicated.
  - 2. Fabricate tops with loose backsplashes for field application.
- F. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

## 2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. Wood Moisture Content: 8 to 13 percent.
  - 2. Softwood Plywood: DOC PS 1.
  - 3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

## 2.4 CABINET HARDWARE AND ACCESSORIES

- A. Basis of Design: MyKnobs.com

1. Brand: Liberty Hardware
  2. Collection: Liberty Kitchen Cabinet Hardware – Special Value Collection
  3. Item #: LIB-23909
  4. Model #: P61200-SC-A
  5. UPC #: 781266110909
  6. 4" Centers
  7. Color: Chrome
  8. Specific Finish: Aluminum
  9. Length 4.38"
  10. Provide hardwood blocking behind hinges the thickness of the face frame by the depth of the hinge.
- B. Concealed Hinges (European Type): BHMA A156.9, B01611, and 170 degrees of opening, self-closing. (Blum "MODUL 170" or equal)
- C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- E. Drawer Slides: BHMA A156.9.
1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
  2. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
  3. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
  4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
  5. For computer keyboard shelves, provide Grade 1HD-100.
- F. Door Locks: BHMA A156.11, E07121.
- G. Drawer Locks: BHMA A156.11, E07041.
- H. Door and Drawer Silencers: BHMA A156.16, L03011.
- I. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- J. Paper Slots: 12 inches long by 1-3/4 inches wide by 1 inch deep; black, molded-plastic, paper-slot liner with 1/4-inch lip.
- K. Tempered Float Glass for Cabinet Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, with exposed edges seamed before tempering, 6 mm thick unless otherwise indicated.
- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.
- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- 2.5 MISCELLANEOUS MATERIALS
- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
  - B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
  - C. Adhesives: Do not use adhesives that contain urea formaldehyde.

## 2.6 FABRICATION

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard, except as herein modified in the drawings and specifications.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate cabinets to dimensions, profiles, and details indicated.
- D. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
  - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## 2.7 SHOP FINISHING

- A. Grade: Provide finishes of same grades as items to be finished.
- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
  - 1. Back-priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require back-priming when surfaced with plastic laminate, or thermoset decorative panels.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

### 3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Cabinets: Install level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.



1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION 06 41 16

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## **SECTION 07 17 00 - BENTONITE WATERPROOFING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes (under grade waterproofing system):
  - 1. Bentonite waterproofing.
  - 2. Molded-sheet drainage panels.
  - 3. Insulation drainage panels.

#### **1.3 PREINSTALLATION MEETINGS**

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

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, and installation instructions.
- B. Shop Drawings: Include installation details for waterproofing, penetrations, and interface with other work.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of waterproofing material.
- B. Preconstruction Test Reports: For water samples taken at Project site along with recommendations resulting from these tests.
- C. Field quality-control reports.
- D. Sample Warranty: For manufacturer's special warranty.

#### **1.6 QUALITY ASSURANCE**

- A. Mockups: Build mockups to set quality standards for fabrication and installation.
  - 1. Build mockup of installation on typical vertical and horizontal surfaces 10 sq. ft. (0.9 sq. m) in size.
  - 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 PRECONSTRUCTION TESTING

- A. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing on ground water.
  1. Obtain water samples from Project site at approximate locations where waterproofing will be installed and test for acids, alkalis, brine, or other contaminants that may inhibit performance of waterproofing materials.
  2. Comply with waterproofing manufacturer's written instructions for testing.

#### 1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturer's written instructions and warranty requirements.
  1. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.
  2. Do not place bentonite clay products in panel or composite form on damp surfaces unless such practice is approved in writing by manufacturer.

#### 1.9 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree(s) to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Twenty (20) years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 COMPOSITE POLYETHYLENE/BENTONITE MEMBRANE

- A. Composite Polyethylene/Bentonite Membrane with Protective Facing: Minimum 170-mil- (4.3-mm-) thick membrane consisting of polyethylene geomembrane bonded to a layer of bentonite and with a protective, nonwoven-geotextile facing.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CETCO, a Minerals Technologies company.
    - b. Mar-flex Waterproofing & Building Products.
    - c. Tremco Commercial Sealants & Waterproofing.
  2. Puncture Resistance: 130 lbf (578 N) according to ASTM D4833 or 169 lbf (752 N) according to ASTM E154.
  3. Vapor Permeance: 0.03 perms according to ASTM E96/E96M.

## 2.2 PROTECTION COURSE

- A. Protection Course: Protection mat of type and thickness as recommended in writing by waterproofing manufacturer for each Project condition.
  - 1. Adhesive: As recommended in writing by waterproofing manufacturer.

## 2.3 MOLDED-SHEET DRAINAGE PANELS

- A. Molded-Sheet Collector-Panel System: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425-mm) sieve laminated to one side of the core, with a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m). Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped subdrainage system.

## 2.4 ACCESSORIES

- A. Granular Bentonite: Sodium bentonite clay containing a minimum of 90 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a No. 20 (0.85-mm) sieve.
- B. Bentonite Mastic: Bentonite compound of trowelable consistency, specifically formulated for application at joints and penetrations.
- C. Bentonite Tubes: Manufacturer's standard 2-inch- (50-mm-) diameter, water-soluble tube containing approximately 1.5 lb/ft. (2.2 kg/m) of granular bentonite; hermetically sealed; designed specifically for placing on wall footings at line of joint with exterior base of wall.
- D. Termination Bar: Extruded-aluminum or formed-stainless-steel bars with upper flange to receive sealant.
- E. Plastic Protection Sheet: Polyethylene sheeting according to ASTM D4397; thickness as recommended in writing by waterproofing manufacturer to suit application but at least 6 mils (0.15 mm) thick.
- F. Cement Grout Patching Material: Grout mix compatible with substrate being patched and recommended in writing by waterproofing manufacturer.
- G. Masonry Fasteners: Case-hardened nails or hardened-steel, powder-actuated fasteners. Depending on manufacturer's written requirements, provide 1/2- or 1-inch- (13- or 25-mm-) diameter washers under fastener heads.
- H. Sealants: As recommended in writing by waterproofing manufacturer. Comply with requirements specified in Section 079200 "Joint Sealants."
- I. Tapes: Waterproofing manufacturer's recommended waterproof tape for joints between sheets, membranes, or panels.
- J. Adhesive: Waterproofing manufacturer's water-based adhesive used to secure waterproofing to both vertical and horizontal surfaces.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations and other conditions affecting performance of bentonite waterproofing.
- B. Examine bentonite materials before installation. Reject materials that have been prematurely exposed to moisture.
- C. Verify that substrate is complete and that work that will penetrate waterproofing is complete and rigidly installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions.
- B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.
- C. Horizontal Concrete Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair the bonding ability of concrete or the effectiveness of waterproofing. Fill voids, cracks greater than 1/8 inch (3 mm), honeycomb areas, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.
- D. Excavation Support and Protection System: If water is seeping, use plastic protection sheets or other suitable means to prevent wetting the bentonite waterproofing. Fill minor gaps and spaces 1/8 inch (3 mm) wide or wider with wood, metal, concrete, or other appropriate filling material. Cover or fill large voids and crevices with cement mortar according to manufacturer's written instructions.

#### 3.3 INSTALLATION, GENERAL

- A. Prepare substrates, voids, cracks, and cavities; and install waterproofing and accessories according to manufacturer's written instructions.
  - 1. Before installing, verify the correct side of waterproofing that shall face substrate surface.
  - 2. Apply granular bentonite around penetrations in horizontal surfaces and changes in plane according to manufacturer's details in preparation for bentonite tubes and mastic.
  - 3. Apply bentonite tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.
  - 4. Prime concrete substrates. Primer may be omitted on concrete surfaces that comply with manufacturer's written requirements for dryness, surface texture, and freedom from imperfections.
- B. Apply bentonite tubes continuously on footing against base of wall to be waterproofed.
- C. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts.
- D. Install protection course before backfilling or placing overburden when recommended in writing by waterproofing manufacturer.

### 3.4 INSTALLATION OF COMPOSITE POLYETHYLENE/BENTONITE MEMBRANE

- A. Install a continuous layer of waterproofing membrane, with ends and edges lapped a minimum of 4 inches (100 mm) unless otherwise indicated. Stagger end joints between membranes a minimum of 24 inches (600 mm). Seal joints with permanent seam tape.
- B. Below Structural Slabs-on-Grade: Apply waterproofing membrane with polyethylene side down, and staple ends and edges.
  - 1. Install under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls, and extend a minimum of 8 inches (200 mm) up or beyond perimeter slab forms.
  - 2. Protect waterproofing from damage caused by reinforcing bar supports with sharp edges.
- C. Slabs: Starting at lowest point, install a continuous layer of waterproofing membrane, with ends and edges lapped a minimum of 4 inches (100 mm).
- D. Concrete Walls: Apply mastic to form continuous 3/4-inch (19-mm) cant or fillet at intersection of footings and walls.
  - 1. Starting at lowest point, install a layer of waterproofing membrane horizontally, extending a minimum of 6 inches (150 mm) onto the footing. Lap membrane ends and edges a minimum of 2 inches (50 mm).
  - 2. Secure membrane to wall.
  - 3. Apply mastic to form continuous 3/4-inch (19-mm) layer around penetrations.
  - 4. Termination at Grade: Extend waterproofing membrane to within 12 inches (300 mm) of finish grade unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.
- E. Excavation Support and Protection (Permanent Shoring): Cut, clean, and treat tiebacks and similar projections. Encase tieback heads, rods, nuts, and plates according to waterproofing manufacturer's written instructions for each configuration. If water is present, cover shoring and lagging with plastic protection sheets; remove plastic sheets before placing concrete.
  - 1. Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped minimum of 4 inches (100 mm) and nailed to shoring.
  - 2. Inspect and repair waterproofing membrane after reinforcing steel has been placed. Coordinate and control concrete placement to avoid damage to waterproofing.

### 3.5 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels according to manufacturer's written instructions. Use adhesives or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
  - 1. For vertical applications, install board insulation and protection course before installing drainage panels.
- B. Molded-Sheet Collector-Panel System: Install according to manufacturer's written instructions. Connect to piped subdrainage system.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed waterproofing installation before covering with other construction, and provide written report stating that installation complies with manufacturer's written instructions.
  - 1. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.
  
- B. Flood Testing: Flood test each deck area for leaks, according to procedures in ASTM D5957 and manufacturer's instructions, after completing waterproofing but before permanent overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
  - 1. Flood to an average depth of 2-1/2 inches (64 mm) with a minimum depth of 1 inch (25 mm), but not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of membrane flashings.
  - 2. Flood each area for 24 hours.
  - 3. After flood testing, repair leaks, repeat flood test, and make further repairs until waterproofing installation is watertight.

END OF SECTION 07 17 00



## **SECTION 07 21 00 - THERMAL INSULATION**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

##### A. Section Includes:

1. Foam Plastic Insulation Board for tapered and non-tapered roof insulation.
2. Mineral-wool blanket insulation where shown on the Drawings.
3. Spray polyurethane foam insulation.

##### B. Related Sections:

1. Section 03 11 19 "Insulating Concrete Forms (ICF).
2. Section 07 14 16 "Cold Fluid Applied Waterproofing Membrane" installed waterproofing, and air and water barrier membrane.
3. Section 06 16 00 "Sheathing" for exterior gypsum panel sheathing board.
4. Section 09 29 00 "Gypsum Board" for Sound Attenuation Blankets (insulation) installation in metal-framed assemblies of insulation specified by referencing this Section.
5. Division 22 Section "Plumbing Insulation."
6. Division 23 Section "HVAC Insulation."

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- B. Research/Evaluation Reports: For foam-plastic insulation, from FBC.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

#### 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.
- C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
  - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
  - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

### PART 2 - PRODUCTS

#### 2.1 FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board, Glass-Fiber-Mat Faced: ASTM C1289, glass-fiber-mat faced, Type II, Class 2.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Atlas Roofing Corporation.
    - b. Carlisle Coatings & Waterproofing Inc.
    - c. Firestone Building Products.
    - d. Johns Manville; a Berkshire Hathaway company.
    - e. Rmax, Inc.
  - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
  - 3. Roof Insulation: Thickness and thermal resistance as indicated on the Drawings. Provide tapered units as required and/or shown on drawings to achieve the required slopes.
  - 4. Wind Speed design for fastening: 200 mph wind speed design.
  - 5. Tapered roof insulation board system required for main low-sloped roof.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

## 2.2 MINERAL-WOOL BLANKET INSULATION

- 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. Fibrex Insulations Inc.
  2. Owens Corning.
  3. Roxul Inc.
  4. Thermafiber.
- B. Faced and unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I; consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Plenum Rating: Provide glass-fiber insulation where ceiling plenums indicated whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
  2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

## 2.3 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84. Refer to Drawings for locations.
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. BASF Corporation.
    - b. BaySystems NorthAmerica, LLC.
    - c. Dow Chemical Company (The).
    - d. ERSystems, Inc.
    - e. Gaco Western Inc.
    - f. Henry Company.
    - g. NCFI; Division of Barnhardt Mfg. Co.
    - h. SWD Urethane Company.
    - i. Volatile Free, Inc.
  2. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.
  3. Thickness/depth applied as indicated on the drawings.
  4. Apply closed-cell spray insulation on all vertical surfaces (including concrete masonry cells and where called for on the drawings.
  5. Apply fire-tested intumescent coating to in-place spray foam where exposed or in a plenum as required by code.
- B. Open-Cell Spray Polyurethane Foam (fill remainder of wall cavity as indicated on drawings): Spray-applied polyurethane foam using water as a blowing agent. Minimum density of 6.4 kg/cu. m and

minimum aged R-value at 1-inch (25.4-mm) thickness of 3.4 deg F x h x sq. ft./Btu at 75 deg F (24 K x sq. m/W at 24 deg C). Refer to Drawings for locations.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
2. Flame-Spread Index: 75 or less.
3. Smoke-Developed Index: 450 or less.
4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

## 2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
    - b. Gemco; Spindle Type.
  2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. AGM Industries, Inc.; TACTOO Adhesive.
    - b. Gemco; Tuff Bond Hanger Adhesive.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

### 3.2 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Mineral-Wool Blanket Insulation: Install where indicated on the drawings in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. For metal-framed wall cavities where cavity heights exceed 96 inches support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- C. Spray-Applied Insulation: Apply spray-applied insulation where indicated on the drawings according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
- D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
  - 2. Drill steel tubes and fill voids with spray insulation where gaps in the insulating planes are present.

### 3.3 INSTALLATION OF INSULATION FOR CONCRETE AND CMU SUBSTRATES

- A. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of substrate by using method recommended by insulation manufacturer.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

### 3.4 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

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**SECTION 07 24 00 - EXTERIOR INSULATION AND FINISH SYSTEM OVER FLUID APPLIED AIR AND WATER-RESISTIVE MEMBRANE BARRIER**

**PART 1 GENERAL**

1.01 SUMMARY

A. Section Includes:

1. Exterior Insulation and Finish System (EIFS) adhered over drainable fluid applied air/water-resistive membrane barrier over prepared Insulated Concrete Forming (ICF) system substrate surface.
2. BASIS OF DESIGN: OUTSULATION® SYSTEM® BY DRYVIT SYSTEMS, INC.
3. STO Brand StoTherm CI Classic EIFS and StoGuard waterproof barrier system (Approved Equal).
4. PAREX USA Standard Water Master System (Approved Equal).

B. Related Requirements:

1. 03 30 00 Cast-In-Place Concrete
2. 07 25 00 Weather-Resistive Barriers
3. 07 14 16.01 Fluid-Applied Air & Water Barriers
4. 07 62 00 Sheet Metal Flashing and Trim
5. 07 92 00 Joint Protection
6. 08 41 15 Exterior Entrances &, Storefronts

1.02 REFERENCES

A. Reference Standards:

1. ASTM Standards:

- a. ASTM B 117 Standard Practice for Operating Salt Spray (Fog) Apparatus
- b. ASTM C 150 Standard Specification for Portland Cement
- c. ASTM C 1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
- d. ASTM C 1397 Standard Practice for Application of Class PB Exterior Insulation and Finish System (EIFS) and EIFS with Drainage
- e. ASTM D 968 Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
- f. ASTM D 2247 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
- g. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
- h. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials
- i. ASTM E 119 Standard Method for Fire Tests of Building Construction and Materials
- j. ASTM E 330 Test Method for Structural Performance of Exterior Windows, Doors and Curtain Walls by Uniform Static Air Pressure Difference
- k. ASTM E 331 Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference
- l. ASTM E 2098 Test Method for Determining the Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to Sodium Hydroxide Solution
- m. ASTM E 2134 Test Method for Evaluating the Tensile-Adhesion Performance of Exterior Insulation and Finish Systems (EIFS)
- n. ASTM E 2430 Standard Specification for Expanded Polystyrene (EPS) Thermal Insulation Boards for use in Exterior Insulation and Finish Systems (EIFS)
- o. ASTM E 2485 Standard Test Method for Freeze-Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water-Resistive Barrier Coatings
- p. ASTM E 2486 Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS)

- q. ASTM E 2568 Standard Specification for PB Exterior Insulation and Finish Systems
- 2. National Fire Protection Association (NFPA) Standards:
  - a. NFPA 268 Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Source
  - b. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies Containing Combustible Components

### 1.03 ADMINISTRATIVE REQUIREMENTS

#### A. Pre-Installation Meetings:

- 1. Pre-Installation Meeting: Coordinate with the General Contractor for a pre-installation meeting regarding EIFS cladding installation and integration with all related envelope components. Representatives of the ICF installer, ICF Manufacturer, EIFS installer, EIFS manufacturer, General Contractor and related envelope components contractors shall participate and review intended substrate preparations, detailing integrations, installation sequencing and responsibilities to assure for complete air and water tight high performance building envelope walls.

#### B. Sequencing: Coordinate Sequencing items with Pre-Installation Meeting.

- 1. Coordinate for ICF joint requirements, joint treatments and surface preparation as outlined herein below in Section 3.02.B in advance of fluid applied air/water-resistive barrier, joint preparation and accessory materials as required.
- 2. Coordinate for jobsite grading (by others) prior to installation of Exterior Insulation and Finish System so that the system may be terminated at 8 in above grade, as required by code or as determined necessary to properly address termination conditions.
- 3. Coordinate installation of wall to foundation waterproofing, wall to roofing membrane, rough opening buck assemblies, windows, doors, and other penetrations of the exterior walls to provide a continuous water tight building envelope.
- 4. Provide protection of rough openings and buck assembly before installing windows, doors, and other penetrations of the exterior walls.
- 5. Provide transition flashing for nail flange type window frames and tie-in to substrate surface or air / water-resistive barrier to provide a continuous barrier. Do not apply flashings at sill flange.
- 6. Coordinate installation of non-nail flange type window and door frames for transition detailing and flashings (by others) and their integration and tie-in to substrate surface or air / water-resistive barrier to provide a continuous barrier.
- 7. Coordinate installation of sill pan flashings with end and side dams (by others) where indicated and provide for their integration tie-in to air / water-resistive barrier to provide a continuous barrier in advance of window installation.
- 8. Coordinate installation of window and door head flashings (by others) where indicated and provide for their integration tie-in to air / water-resistive barrier to provide a continuous barrier immediately after windows and doors are installed.
- 9. Coordinate installation of diverter flashings and stepped parapet coping boots and flashings (by others) and provide for their integration tie-in to substrate surface or air / water-resistive barrier to provide a continuous barrier immediately after flashings are installed.



10. Coordinate installation of copings and sealants (by others) immediately after installation of the Exterior Insulation and Finish System and when EIFS materials are dry.
11. Coordinate attachment penetrations for all wall mounted components (by others) through Exterior Insulation and Finish System to structural support and provide water-tight seals at penetrations in accordance with EIFS manufacturer's recommended detailing.

#### 1.04 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

- A. Submit product data as required by Section 01 33 00, Administrative Requirements.
- B. Submit two (2) samples of the Exterior Insulation and Finish System for each finish, texture, and color to be used on the project. Use the same tools and techniques proposed for the actual installation. Make the samples of sufficient size to accurately represent each color and texture being utilized on the project.
- C. Submit a current copy of the manufacturer's Trained Contractor Certificate for the system and finish specified.
- D. Submit Owner/Architect-requested test results verifying the performance of the Exterior Insulation and Finish System.
- E. Submit a copy of the manufacturer's specifications, installation details and application instructions for the system and finish specified.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Submit a copy of the manufacturer's recommended maintenance and repair manual.
- B. Submit executed Exterior Insulation and Finish System manufacturer's specified warranty.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
  1. A member in good standing of the EIFS Industry Members Association (EIMA) for a minimum of five (5) years.
  2. Manufacture Exterior Insulation and Finish System materials at a facility covered by a current ISO 9001:2008 and ISO 14001:2004 certification. Certification of the facility is done by a registrar accredited by the American National Standards Institute, Registrar Accreditation Board (ANSI-RAB).
- B. Contractor Qualifications:
  1. Knowledgeable in the proper installation of the Fluid Applied Air/Water-Resistive Membrane Barrier and Exterior Insulation and Finish System.
  2. Possess a current Training and Listing Certificate issued by the EIFS Manufacturer for the specific EIFS system and/or finish as specified herein.
  3. Successfully complete a minimum of three (3) projects of similar scope and scale to the specified project.
- C. Insulation Board Manufacturer Qualifications:
  1. Listed by and capable of producing the Expanded Polystyrene (EPS) in accordance with the current EIFS Manufacturer's Specification for Insulation Board.
  2. Subscribe to the EIFS Manufacturer's Third-Party Certification and Quality Assurance Program.

3. Supplied through the EIFS Manufacturer's authorized distribution network.

F. Mock-Up:

1. Provide the Owner/Architect with a mock-up for approval.
  - a. Of suitable size as required to accurately represent the products being installed, as well as each color and texture to be utilized on the project. Coordinate for size and location during Pre-Installation Meeting.
  - b. Prepared with the same products, tools, equipment and techniques required for the actual applications. Use finish from the same batch that is being used on the project.
  - c. Available and maintained at the jobsite.
  - d. Incorporate into Contractor's wall mock-up with opening details, flashings and sealants, trim, and cornice work examples.

H. Inspections:

1. Cooperate with independent, third-party inspectors where required by building code, local authority having jurisdiction or by contract documents.

#### 4.07 DELIVERY, STORAGE AND HANDLING

1. Deliver all Exterior Insulation and Finish System components and materials to the job site in the original, unopened packages with labels intact.
2. Inspect all Exterior Insulation and Finish System components and materials upon arrival for physical damage, freezing or overheating. Do not use questionable materials.
3. Store all Exterior Insulation and Finish System components and materials at the jobsite in a cool, dry location, out of direct sunlight, protected from weather and other sources of damage. Maintain minimum and maximum storage temperature as stated in the product data sheets or specifications for the materials selected.
4. Protect all products from inclement weather and direct sunlight.

#### 4.08 SITE CONDITIONS

A. Ambient Conditions

1. Do not apply wet materials during inclement weather unless appropriate protection is provided. Protect materials from inclement weather until they are completely dry.
2. Verify the minimum air and application surface temperatures at the time of application as stated in the product data sheets or specifications for the materials selected.
3. Maintain these temperatures with adequate air ventilation and circulation for a minimum of 24 hours (or as additionally required for specialty products) thereafter, or until the products are completely dry.

#### 4.09 DESIGN REQUIREMENTS

- A. Acceptable surfaces for the air/water-resistive membrane barrier materials shall consist of ICF molded EPS manufactured with buried webs or additional layer of EPS foam insulation board.
- B. The specified ICF shall comply with all applicable code requirements for the construction type (combustible or non-combustible). Details shall conform with proper termination requirements for combustible or non-combustible construction (refer to published details).

- C. The substrate shall be flat and smooth.
- D. Coordinate for integration of Expansion and Control Joint locations.

#### 1.10 WARRANTY

1. Manufacturer shall offer a limited material defect and labor to repair or replace defective material warranty stating the Products will be free from manufacturing defect and will perform as warranted in the manner specified for the stated term measured from the Date of Project Substantial Completion.
  - a. A pre-construction meeting, including representatives of the Manufacturer, the Applicator, the Owner, and the Consultant (if applicable), shall be required prior to installation of the Products.
  - b. The term of this warranty shall be extended for an additional 2 years with involvement on the project of the Architect consultant ("Consultant") engaged by the Owner or its authorized representative, at the Owner's sole expense. Inspection reports generated by the Consultant shall be made available to the Company and the Owner.
  - c. The warranty is available upon written request.
2. The EIFS warranty shall additionally include the following for the term of the warranty or as specifically noted hereunder.

**(Note: An additional 2-year EIFS warranty extension shall be provided with Machine Pre-Base Coated Shapes as referenced in Section 2.02.B.9 below and Silicone Joint Sealants as referenced in Section 2.02.C.1 to be integrated.)**

  - a. The warranty term shall be **Fifteen (15) years**.
  - b. The EIFS will remain in a watertight condition when the EIFS is used in conjunction with approved Company Joinery and Sealants.
  - c. Finish will be UV fade resistant for 15 years, except for specially produced colors.
    - 1)Specially produced colors will be UV fade resistant for 10 years when high-performance colorants are used to formulate.
  - d. The EIFS shall be eligible to receive a renewal of the original warranty if the Owner satisfactorily completes the specific renovation requirements published by the Manufacturer.

#### B. Installer Warranty

1. **EIFS system Installer shall provide a separate minimum Five (5) year warranty. The EIFS system Installer shall warrant workmanship separately** for all workmanship related to the proper installation and drainage performance of the EIFS application. Manufacturer shall not be responsible for workmanship associated with the installation of Exterior Insulation and Finish System with Moisture Drainage.

## PART 2 - PRODUCTS

### 2.01 EIFS SYSTEM / MANUFACTURER

- A. EIFS System Basis of Design: Outsulation® Exterior Insulation and Finish System (EIFS as manufactured by Dryvit Systems, Inc., One Energy Way, West Warwick, RI 02893, 800-556-7752, [www.dryvit.com](http://www.dryvit.com)).
  1. Project Contact:
    - a. Rick Mangan, Technical Sales Representative, Dryvit Systems, Inc. – [rick.mangan@dryvit.com](mailto:rick.mangan@dryvit.com) / 407-701-3744.
  2. All components of the Outsulation® System including EPS Insulation Board shall be supplied or obtained from Dryvit Systems, Inc. or its authorized distributors. Substitutions or additions of materials manufactured or supplied by others will void the system warranty and are not acceptable.
  3. STO Brand StoTherm CI Classic EIFS and StoGuard waterproof barrier system (Approved Equal).
  4. PAREX USA Standard Water Master System (Approved Equal).
- B. Substitution Limitations:

1. All components of the Outsulation® System including EPS Insulation Board shall be supplied or obtained from Dryvit Systems, Inc. or its authorized distributors. Substitutions or additions of materials manufactured or supplied by others will void the system warranty.
2. Alternate EIFS manufacturers must demonstrate equivalency for all elements of EIFS system such as but not limited to:
  - a. Material components;
  - b. Tested compatibility of EIFS, air/water-resistive barrier and ICF;
  - c. Standard and specialty finishes;
  - d. Color and texture matching; and,
  - e. Warranty criteria as specified herein.
3. Submit alternate EIFS manufacturer's complete data highlighting equivalency for review through Substitution Requirements prior to Bidding as defined in Division 1, Section 00 82 00, Special Conditions, Article 15.

## 2.02 DESCRIPTION

### A. System Description:

1. Dryvit Outsulation System over air/water-resistive barrier over ICF is an Exterior Insulation and Finish System (EIFS); consisting of:
  - a. Fluid applied air and water-resistive membrane barrier over prepared ICF substrate
  - b. Adhesive – installed in vertical notched trowel ribbons to facilitate egress of incidental moisture
  - c. Expanded Polystyrene (EPS) insulation board, including special machine fabricated shapes
  - d. Base Coat
  - e. Reinforcing Mesh
  - f. Finish Coat

### B. Materials:

1. Air and Water-Resistive Membrane Barrier and Accessory Materials
  - a. Tremco ExoAir 230: A fluid-applied, synthetic, permeable, elastomeric air/water-resistive membrane barrier designed to be roller or spray applied as manufactured by Tremco, Inc.
  - b. Tremco Dymonic 100: A high-performance, high-movement, single-component, medium-modulus, low-VOC, UV-stable, non-sag polyurethane sealant as manufactured by Tremco Inc.
2. Flashing:
  - a. AquaFlash®: Fluid-applied, water-based polymer transition membrane.
  - b. AquaFlash Mesh: Polyester reinforcing mesh for use with AquaFlash.
  - c. Dryvit Flashing Tape™: Rubberized asphalt adhesive membrane.
  - d. Dryvit Flashing Tape Surface Conditioner™: Water-based surface conditioner and adhesion promoter for use with Flashing Tape.
4. Adhesives:
  - a. Liquid polymer-based adhesive field mixed with Portland cement.
    - 1) Dryvit Primus® or Dryvit Genesis®
  - b. Ready mixed dry blend cementitious, copolymer-based adhesive field mixed with water.
    - 1) Dryvit Primus® DM or Dryvit Genesis® DM
5. Insulation Board:
  - a. Expanded Polystyrene (EPS): Minimum thickness shall be 25 mm (1.5 in); or, as required to comply with local energy codes and wall assembly design; or, as shown on contract drawings and meeting Dryvit Specification DS131 and ASTM E 2430.
  - b. The insulation board shall be manufactured by a board supplier listed by Dryvit Systems, Inc.

- c. The insulation board shall be supplied through Dryvit's authorized distributor network.
  - d. Provide special machine fabricated shapes as shown on the Drawings.
6. Machine Coated Starter Boards, Trims, Corners and Shapes:
- a. Pre-Base Coated EPS Components: Provide and integrate pre-base coated starter / edge boards, trims, corners and shapes manufactured with materials produced by EIFS Manufacturer and shall be included under the EIFS System Warranty.
7. Base Coat:
- a. Liquid polymer-based adhesive field mixed with Portland cement.
    - 1) Dryvit Primus® or Dryvit Genesis®
  - b. Ready mixed dry blend cementitious, copolymer-based adhesive field mixed with water.
    - 1) Dryvit Primus® DM or Dryvit Genesis® DM
8. Reinforcing Mesh:
- a. A balanced open-weave, glass fiber fabric treated for compatibility with other system materials.
    - 1) Dryvit Standard, Standard Plus, Intermediate, Panzer 15, Panzer 20, Detail and Corner Mesh or combinations thereof as specified herein to achieve required impact resistance and proper installation.
  - b. Provide for Ultra-High Impact Mesh Assembly with 4.3 oz. mesh installed over Panzer 20.0 oz. mesh for all EIFS areas within 7'-6" above finish floor and/or where indicated on drawings.
  - c. Mesh shall be colored blue for product identification bearing the Dryvit logo.
9. Finish Coat:
- a. Standard DPR Finishes: 100% water-based acrylic polymer finish with integral color and texture; formulated with Dirt Pickup Resistance (DPR) chemistry.
    - 1) Standard Texture: Select from EIFS Manufacturer's Standard textures.
      - i. Sandpebble Fine® DPR, from grade to 9'-0" above first finished floor,
      - ii. Finesse® DPR, Freestyle® DPR from 9'-0" above finish first floor to top of building.
    - 2) Color: Select from EIFS Manufacturer's standard full range 288 color offering.
10. Jobsite-Mixed Materials:
- a. Portland cement: Verify is Type I or II, meeting ASTM C 150, white or gray in color, fresh and free of lumps.
  - b. Water: Verify is clean and free of foreign matter.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

#### **A. Verification of Conditions:**

1. Verify access to electric power, clean water and a clean work area at the location where the Dryvit materials are to be applied.
2. Verify that the ICF wall surface on which fluid applied air/water-resistive membrane barrier is to be installed is an approved substrate
3. Verify that the fluid applied air/water-resistive membrane barrier surface on which Exterior Insulation and Finish System is to be installed is an EIFS Manufacturer-approved substrate:
4. Verify the deflection of the substrate does not exceed 1/240 times the span.

5. Verify substrate is flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.
6. Verify substrate is sound, dry, connections are tight; has no surface voids, projections, or other conditions that may interfere with the Exterior Insulation and Finish System installation or performance.
7. Verify the slope of inclined surfaces are not less than 6:12 (27 °), and the length of the slope does not exceed 305 mm (12 in).
8. Verify metal roof flashings have been installed in accordance with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) standards.
9. Verify all rough openings and buck assemblies are flashed in accordance with the Exterior Insulation and Finish System manufacturer's installation details, or as otherwise necessary to prevent water penetration. Verify chimneys, balconies, decks and stepped parapet copings have been properly flashed as necessary to prevent water penetration.
10. Verify windows and doors are installed and flashed per manufacturer's requirements and installation details.
11. Notify general contractor of all discrepancies prior to the installation of the Exterior Insulation and Finish System.
12. Verify that expansion joints are installed:
  - a. Where expansion joints occur in the substrate system.
  - b. Where building expansion joints occur.
  - c. Where the Exterior Insulation and Finish System abuts dissimilar materials.
  - d. Where the substrate type changes.
  - e. In continuous elevations at intervals not exceeding 23 m (75 ft).
  - f. Where significant structural movement occurs, such as changes in roof line, building shape or structural system.
13. Coordinate for use and location of interior vapor retarder.

### 3.02 PREPARATION

- A. Prepare the substrates to be free of foreign materials, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion of air/water-resistive membrane barrier to ICF or EIFS to air/water-resistive membrane barrier.
- B. Preparation of ICF Substrate:
  1. The expanded polystyrene (EPS) foam used in the manufacture of ICF systems will oxidize when exposed to prolong periods of ultra violet (UV) light, typically 60 to 90 days. The oxidization manifests on the exposed surface of the ICF form as a chalky dust film. It is recommended that the oxidized layer (chalky dust) remain undisturbed until just prior to the application of any direct applied air/water-resistive membrane barrier or finish system. The EPS surface should be lightly brushed and washed (hosed down) with clean water to remove the oxidized layer. The EPS surface should be left to fully dry before application of any. Additional surface preparations such as but not limited to rasping the surface, may be required as recommended by the direct applied air/water-resistive membrane barrier or finish system supplier/manufacturer.
  2. Vertical and horizontal panel joints 1/8" or greater in the ICF surface should be filled level with surface using a compatible low expansion foam, slivers of EPS and/or joint sealant as recommended by the air/water-resistive membrane barrier manufacturer.

3. All flashing, sealants and barrier membranes must provide compatibility and adhesion testing with the ICF system in accordance with ASTM D4541. Adhesion testing results must achieve a minimum of 20 PSI pull-off resistance. Additional surface and joint preparation may be required in accordance with manufacturer's or supplier's recommendations.
- C. Protect the air/water-resistive membrane barrier and Exterior Insulation and Finish System materials by permanent or temporary means from inclement weather and other sources of damage prior to, during, and following application until completely dry.
- D. Protect adjoining work and property during installation of the Exterior Insulation and Finish System.

### 3.03 INSTALLATION

- A. Install the air/water-resistive membrane barrier and accessory materials in strict accordance with their respective application instructions.
- B. Install and integrate all third party flashing components and tie into air/water-resistive membrane barrier surface with accessory materials as required.
- C. Install the EIFS system in accordance with ASTM C1397 and the Dryvit Outsulation System Application Instructions DS 204.
- D. Apply base coat sufficient to fully embed the reinforcing mesh so that no mesh color can be seen. The recommended method is to apply the base coat in two (2) passes.
- E. Apply sealant only to base coat treated with Dryvit Demandit or Color Prime coatings.
- F. Install high impact reinforcing mesh as specified at ground level, high traffic areas and other areas exposed to or susceptible to impact damage as designated on contract drawings.

### 3.04 SITE QUALITY CONTROL

- A. Air/water-resistive membrane barrier and Exterior Insulation and Finish System manufacturer assumes no responsibility for on-site inspections or application of its products.
- B. EIFS sub-contractor to certify in writing the quality of work performed relative to the substrate system, air/water-resistive membrane barrier, details, installation procedures, and as to the specific products used.
- C. EPS supplier, if requested, to certify in writing that the EPS meets the Exterior Insulation and Finish System manufacturer's specifications.
- D. The sealant contractor, if requested, to certify in writing that the sealant application is in accordance with the sealant manufacturer's and the Exterior Insulation and Finish System manufacturer's recommendations.

### 3.05 CLEANING

- A. Remove all excess air/water-resistive membrane barrier and Exterior Insulation and Finish System materials from the job site by the contractor(s) in accordance with contract provisions and as required by applicable law.
- B. Leave all surrounding areas, where the Exterior Insulation and Finish System has been applied, free of debris and foreign substances resulting from the EIFS sub-contractor's work.

END OF SECTION 07 24 00

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## **SECTION 07 27 13-SELF-ADHERED SHEET MEMBRANE AIR BARRIER**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. The work of this section includes, but is not limited to, the following:
  - 1. Materials and installation methods for applied air and vapor barrier membrane system to exterior face of sheathing prior to application finish system where indicated on the drawings.
  - 2. Materials and installation methods to bridge and seal air leakage pathways in other penetrations through the construction assembly.
  - 3. Also referred to "Peel-N-Stick" membrane on the Drawings.
- B. Related Sections: Other specification sections that directly relate to the works of this section include, but are not limited to, the following:
  - 1. Section 07 14 16 – Cold Fluid Applied Waterproofing
  - 2. Section 07 60 00 – Flashing and Sheet Metal
  - 3. Section 07 90 00 – Joint Sealers

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide an air and vapor barrier system to perform as a continuous barrier to air infiltration/exfiltration and water vapor transmission and to act as a liquid water drainage plane flashed to discharge any incidental condensation or water penetration.
- B. Air barrier penetrations:
  - 1. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

#### 1.4 REFERENCES

- A. The following standards and publications are applicable to the extent referenced in the text. The most recent version of these standards is implied unless otherwise stated.
- B. American Society for Testing and Materials (ASTM)
  - 1. E96 Test Methods for Water Vapor Transmission of Materials
  - 2. D570 Test Method for Water Absorption of Plastics
  - 3. D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
  - 4. D1938 Test Method for Tear Propagation Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method
  - 5. D1876 Test Method for Peel Resistance of Adhesives
  - 6. D1970 Standard Specifications for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment
  - 7. D412 Test Methods for Vulcanized Rubber & Thermoplastic Rubbers and Thermoplastic Elastomers – Tension
  - 8. E2178 Standard Test Method for Air Permeance of Building Materials
  - 9. E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

## 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and substrate preparation recommendations.
- B. Shop drawings showing locations and extent of air and vapor barrier system including details for terminations flashings, penetrations, window and door openings and treatment of substrate joints and cracks.
- C. Written documentation demonstrating installers qualifications under the "Quality Assurance" article including reference projects of a similar scope.
- D. Samples: Submit representative samples of the following for approval:
  - 1. Self-Adhered Air Barrier Membrane
  - 2. Self-Adhered Transition Membrane
- E. Warranty: Submit a sample warranty identifying the terms and conditions stated in Section 1.09.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer: Air and vapor barrier systems shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of waterproofing and air barrier products. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified and include a list of projects of similar design and complexity completed within the past five years.
- B. Installer: The installer shall demonstrate qualifications to perform the work of this Section by submitting the following:
  - C. List of at least three (3) projects contracted within the past five (5) years of similar scope and complexity to this project carried out by the firm and site supervisor.
  - D. Installer must show evidence of adequate equipment and trained field personnel to successfully complete the project in a timely manner.
  - E. Materials: Self-adhered air and vapor barrier material shall be 40 mil; comprising 36 mil rubberized asphalt integrally bonded to 4 mil cross-laminated polyethylene film. For each type of material required for the work of this section, provide primary materials that are the products of one manufacturer.
  - F. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include but not be limited to the following:
    - 1. Review of submittals.
    - 2. Review of surface preparation, minimum curing period and installation procedures.
    - 3. Review of special details and flashings.
    - 4. Sequence of construction, responsibilities and schedule for subsequent operations.
    - 5. Review of mock-up requirements.
    - 6. Review of inspection, testing, protection and repair procedures.
- G. Mock-up:
  - 1. Prior to installation of the air and vapor barrier system a field-constructed mock-up shall be provided under the provisions of Section 01340 – Shop Drawings, Product Data, Samples and Mock-ups to verify details and tie-ins and to demonstrate the required quality of materials and installation.
  - 2. Construct a typical exterior wall section, 8 feet long and 8 feet wide, incorporating back-up wall, cladding, flashing and any other critical junction.
  - 3. Allow 24 hours for inspection and testing of mock-up before proceeding with air and vapor barrier work.
  - 4. Mock-up may remain as part of the work.
- H. Inspection and Testing: Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed air and vapor barrier membrane until it has been inspected, tested and approved.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer’s instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
- B. Do not double-stack pallets of membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
- C. Protect membrane components from freezing and extreme heat.
- D. Sequence deliveries to avoid delays, but minimize on-site storage.

1.8 PROJECT CONDITIONS

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials used. Proceed with installation only when the substrate construction and preparation work is complete and in condition to receive the air and vapor barrier membrane.

1.9 WARRANTY

- A. Submit manufacturer's warranty that air and vapor barrier and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical properties and material specifications.

PART 2 - PRODUCTS

2.1 GENERAL

- A. For each type of material required for the work of this section, provide primary materials that are the products of one manufacturer.

2.2 SELF-ADHERED AIR BARRIER MEMBRANE

- A. Description: Min. 1 mm thick membrane comprised of 0.9 mm of self-adhesive rubberized asphalt integrally bonded to 0.1 mm of cross-laminated, high-density polyethylene film. Membrane shall be interleaved with disposable silicone-coated release paper until installed.
- B. Performance Requirements:

Property	Test Method	Typical Value
Thickness	ASTM D 3767 Method A	1.0 mm (0.040 in.) nominal
Air Permeance at 75Pa (0.3 in. water) Differential Pressure	ASTM E 2178	<0.001 L/(s.m <sup>2</sup> ) (<0.0002 cfm/ft <sup>2</sup> )
Assembly Air Permeance at 75Pa (0.3 in. water) Differential Pressure	ASTM E 2357	<0.004 L/s*m <sup>2</sup> (<0.0008 cfm/ft <sup>2</sup> )
Water Vapor Permeance	ASTM E 96, Method B	Less than 2.9 ng/Pa.s.m <sup>2</sup> (0.05 Perms)
Water Absorption: -	ASTM D 570	Max. 0.1% by weight
Puncture Resistance	ASTM E 154	178 N (40 lbs.)
Tear Resistance	Initiation - AST	Min. 58 N (7.0 lbs.) M.D. Min. 40 N (4.0 lbs.) M.D.

	M D 1004 Propagati on	
	- ASTM D1938	
Lap Adhesion at -4°C (25°F)	ASTM D 1876	880 N/m (5.0 lbs./in.) of width
Low Temperature Flexibility	ASTM D 1970	Unaffected to -43°C (-45°F)
Tensile Strength	ASTM D 412, Die C Modified	Min. 2.7 MPa (400 psi)
Elongation, Ultimate Failure of Rubberized Asphalt	ASTM D 412 - Die C	Min. 200%

C. Materials:

1. Perm-A-Barrier® Wall Membrane from Grace Construction Products, 62 Whittemore Avenue, Cambridge, MA.

2.3 TRANSITION MEMBRANE

- A. Description: Min. 1 mm (.040 in) thick membrane comprised of 0.9 mm (0.036 in) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (.004 in) of cross-laminated, high-density polyethylene film. Membrane shall be interleaved with disposable silicone-coated release paper until installed.

B. Performance Requirements:

1. Water Vapor Transmission: ASTM E 96, Method B:  
2.9 ng/m<sup>2</sup>sPa (0.05 perms) max.
2. Air Permeance at 75Pa (0.3 in. water) pressure difference: 0.0006 L/(s.m<sup>2</sup>) (0.00012 cfm/ft<sup>2</sup>) max.
3. Puncture Resistance:  
ASTM E 154: 178 N (40 lbs.) min.
4. Lap Adhesion at -4°C (25°F), ASTM D 1876:  
880 N/m (5.0 lbs./in.) of width min.
5. Low Temperature Flexibility, ASTM D 1970:  
Unaffected to -43°C (-45°F).
6. Tensile Strength, ASTM D 412, Die C Modified:  
min. 2.7 MPa (400 psi)
7. Elongation, Ultimate Failure of Rubberized Asphalt, ASTM D 412 Die C: min. 200%

C. Materials:

1. Perm-A-Barrier Detail Membrane manufactured by Grace Construction Products.

2.4 AIR & VAPOR BARRIER ACCESSORIES

- A. Primer: Water-based primer which imparts an aggressive, high tack finish on the treated substrate

1. Flash Point: No flash to boiling point
2. Solvent Type: Water
3. VOC Content: Not to exceed 10 g/l
4. Application Temperature: -4°C (25°F) and above

5. Freezing point (as packaged): -7°C (21°F)
  6. Product: Perm-A-Barrier WB Primer manufactured by Grace Construction Products.
- B. Sealant: Two-part, elastomeric, trowel grade material designed for use with self-adhered membranes and tapes. 10 g/l max. VOC Content.
1. Product: Bituthene® Liquid Membrane manufactured by Grace Construction Products.
- C. Optional Primers:
1. Description: High tack water based primer. 10 g/l max. VOC content.
    - a. Product: Perm-A-Barrier Liquid Part B manufactured by Grace Construction Products.
  2. Description: High tack low VOC solvent based primer. <200 g/l max. VOC content.
    - a. Product: Bituthene Primer B2 LVC manufactured by Grace Construction Products.
  3. Description: High tack solvent based primer. 440 g/l max. VOC content.
    - a. Product: Bituthene Primer B2 manufactured by Grace Construction Products.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

#### 3.2 PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied waterproofing.
- B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws in accordance with exterior sheathing manufactures written instructions.
- C. Related Materials: Treat construction joints and install flashing as recommended by air barrier manufacturer.

#### 3.3 INSTALLATION

- A. Refer to manufacturer's literature for recommendations on installation
- B. Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- C. Application of Self-Adhered Air Barrier Membrane
  1. Install air & vapor barrier to dry surfaces at air and surface temperatures of -4°C (25°F) and above in accordance with manufacturer's recommendations, at locations indicated on Construction Documents.
  2. Prime substrate to receive air barrier membrane as required per manufacturers written instructions.
  3. Precut pieces of air & vapor barrier into easily handled lengths.
  4. Remove silicone-coated release paper and position membrane carefully before placing length horizontally against the surface.
  5. Begin installation at the base of the wall placing top edge of membrane immediately below any masonry reinforcement or ties protruding from substrate.

6. When properly positioned, place against surface by pressing firmly into place. Roll membrane with extension-handled countertop roller immediately after placement.
7. Overlap horizontally adjacent pieces 50 mm (2 in.) and roll seams.
8. Subsequent sheets of membrane applied above shall be positioned immediately below masonry reinforcement or ties. Bottom edge shall be slit to fit around reinforcing wires or ties, and membrane shall overlap the membrane sheet below by 50 mm (2 in.). Roll firmly into place.
9. Seal around all penetrations with termination mastic.
10. Coordinate the installation of air & vapor barrier with roof installer to ensure continuity of membrane with rooftop air & vapor membrane.
11. At end of each working day seal top edge of air & vapor barrier to substrate with termination mastic.
12. Do not allow the rubberized asphalt surface of the air & vapor barrier membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.
13. Do not expose air & vapor barrier membrane to sunlight for more than thirty days prior to enclosure.
14. Inspect installation prior to enclosing and repair punctures, damaged areas and inadequately lapped seams with a patch of the membrane sized to extend 150 mm (6 in.) in all directions from the perimeter of the affected area.

D. Application of Transition Membrane

1. Prime substrate to receive transition membrane as required per manufacturers written instructions.
2. Apply transition membrane with a minimum overlap of 75mm (3 in.) onto each surface at all beams, columns and joints as indicated in detail drawings.
3. Tie in to window and door frames, spandrel panels, roof and floor intersections and changes in substrate.
4. Use pre-cut, easily handled lengths for each location.
5. Remove silicone-coated release paper and position membrane flashing carefully before placing it against the surface.
6. When properly positioned, place against surface by pressing firmly into place by hand roller.
7. Overlap adjacent pieces 50 mm ( 2 in.) and roll all seams with a hand roller.
8. Seal top edge of flashing with termination mastic.
9. When transition flashing is pre-installed prior to application of Fluid Applied Membrane, apply transition flashing as above. Spray or trowel a continuous uniform film of Fluid Membrane at min. 60 mils (1.5 mm or .060 in.) dry film thickness using multiple, overlapping passes, with a minimum overlap of 75 mm (3 in.) onto transition flashing. For sill condition, spray or trowel Fluid Membrane onto pre-installed sill flashing and onto horizontal section of sill.

3.4 PROTECTION AND CLEANING

- A. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work using procedures as recommended by manufacturer.
- B. Perm-A-Barrier Wall Membrane is not suitable for permanent exposure and should be protected from the effects of sunlight.
- C. Schedule work to ensure that the Perm-A-Barrier Wall Membrane system is covered as soon as possible after installation. Protect Perm-A-Barrier Wall Membrane system from damage during subsequent operations. If the Perm-A-Barrier Wall Membrane system cannot be covered within 30 days after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.

END OF SECTION 07 27 13

## SECTION 07 27 26.03 – FLUID-APPLIED MEMBRANE AIR BARRIERS, VAPOR PERMEABLE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes fluid-applied, vapor-permeable membrane air barriers.

#### 1.2 RELATED REQUIREMENTS

1. Section 03 31 00 "Cast-in-Place Concrete" for moisture curing of concrete waterproofing substrate.
2. Section 03 40 00, Pres-Stressed Hollow Core Plank for compatibility with flashing components.
3. Section 04 20 00 "Unit Masonry" for air barrier substrates and compatibility with flashing components.
4. Section 07 17 00 "Bentonite Waterproofing" for requirements of elevator shaft walls and slab waterproofing below grade.
5. Section 07 92 00 "Joint Sealants" for joint sealants for compatibility and accessories and joint preparation.
6. Division 07 Roofing Sections for roof assembly air barriers and interface coordination.
7. Division 08 Exterior openings sections for framing for aluminum-framed entrances and storefronts louvers and vents receiving air barrier transition assembly specified in this Section.

#### 1.3 REFERENCES

- A. References, General: Versions of the following standards current as of the date of issue of the project apply to the Work of this Section.
- B. ASTM International (ASTM): [www.astm.org](http://www.astm.org):

1. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants
2. ASTM C 1193 - Guide for Use of Joint Sealants
3. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
4. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials
5. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials
6. ASTM E 162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
7. ASTM E 783 - Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors
8. ASTM E 1186 - Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
9. ASTM E 2178 - Standard Test Method for Air Permeance of Building Materials
10. ASTM E 2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

- C. National Fire Protection Association (NFPA): [www.nfpa.org](http://www.nfpa.org):

1. NFPA 285 - Standard Fire Test Method For Evaluation Of Fire Propagation Characteristics Of

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.
- B. Preinstallation Conference: Conduct conference at Project Site.

1. Review requirements for air barrier products and installation, project and manufacturer's details, mockups, testing and inspection requirements, and coordination and sequencing of air barrier work with work of other Sections.
2. Review manufacturer's instructions for air barrier application meeting Project requirements for substrates specified, including three-dimensional video model demonstrating proper application of components at wall openings.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of air barrier product specified, including:
1. Technical data indicating compliance with requirements.
  2. Substrate preparation instructions and recommendations.
- B. Shop Drawings: Show locations for air barrier. Show details for each type of substrate, joints, and edge conditions, including flashings, counterflashings, penetrations, transitions, and terminations.
1. Show location of transition and accessory materials providing connectivity throughout the assemblies.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, and Air Barrier Inspector.
1. Certification of manufacturer's approval of Installer.
- B. Manufacturer's Product Compatibility Certificate: Certify compatibility of air barrier products with adjacent materials.
- C. Fire Propagation Characteristics Certificate: From a qualified testing agency, documentation that air barrier system as a component of a wall assembly has been tested and passed NFPA 285. Include system classification number of testing agency on shop drawings.
- D. Product Test Reports: Test data for air barrier products and air barrier assembly, by qualified testing agency, indicating proposed membrane air barrier meets performance requirements, when requested by Architect.
- E. Warranty: Sample of unexecuted manufacturer and installer special warranties.
- F. Field quality control reports.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm with minimum five years' experience in installation of specified products in successful use on similar projects, employing workers trained by manufacturer, including a full-time on-site supervisor with a minimum of three years experience installing similar work, able to communicate verbally with Contractor[, Architect,] and employees.
- B. Manufacturer Qualifications: A qualified manufacturer listed in this Section with minimum ten years' experience in manufacture of air barrier membrane as one of its principal products.
1. Manufacturer's product submitted has been in satisfactory operation on five similar installations for at least five years.
  2. Manufacturer is accredited by the Air Barrier Association of America.



3. Approval of Manufacturers and Comparable Products: Submit the following in accordance with project substitution requirements for review in accordance with Section 00 82 00, Special Conditions Article 15, Substitutions:
    - a. Completed and signed Substitution Request form.
    - b. Product data, including certified independent test data indicating compliance with requirements.
    - c. Sample shop drawings from similar project.
    - d. Project references: Minimum of five installations of similar system not less than five years old, with Owner and Architect contact information.
    - e. Certificate of ABAA accreditation if required for Project.
    - f. Sample warranty.
  - C. Air Barrier Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified air barrier system, qualified to perform observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Inspector shall be one of the following:
    1. An authorized full-time technical employee of the manufacturer.
    2. A independent party certified as an air barrier inspector by the ABAA or other certifying organization acceptable to Architect, retained by the Contractor.
  - D. Mockups: Provide air barrier mockup application within mockups required in other sections, or if not specified, in an area of not less than 150 sq. ft. (14 sq. m) of wall surface where directed by Architect for each type of backup wall construction. Include examples of surface preparation, crack and joint treatment, air barrier application, and flashing, transition, and termination conditions, to set quality standards for execution.
    1. Include intersection of wall air barrier with roof air barrier and with foundation wall intersection.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Accept materials on site in manufacturer's unopened original packaging.
  - B. Store products in weather protected environment, clear of ground and moisture, within temperature ranges recommended by air barrier manufacturer.
  - C. Construction Waste: Store and dispose of packaging materials and construction waste in accordance with requirements of Division 01 Section "Construction Waste Management".
- 1.9 ENVIRONMENTAL REQUIREMENTS
- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
    1. Protect substrates from environmental conditions that affect air-barrier performance.
    2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.
- 1.10 SCHEDULING
- A. Coordinate installation of membrane air barrier with completion of roofing and other work requiring interface with air barrier.
  - B. Schedule work so air barrier applications may be inspected prior to concealment.

- C. Ensure air barrier materials are cured before covering with other materials.

#### 1.11 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which air barrier manufacturer agrees to furnish and install air barrier material to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as specified under normal use within warranty period specified.
  - 1. Access for Repair: Owner shall provide unimpeded access to the Project and the air barrier system for purposes of testing, leak investigation, and repair, and shall reinstall removed cladding materials upon completion of repair.
  - 2. Cost Limitation: Manufacturer's obligation for repair or replacement shall be limited to the original installed cost of the work.
  - 3. Warranty Period: 10 years date of Substantial Completion.
- B. Special warranties specified in this article exclude deterioration or failure of air barrier materials from the following:
  - 1. Movement of the structure caused by structural settlement or stresses on the air barrier exceeding manufacturer's written specifications for elongation.
  - 2. Mechanical damage caused by outside agents.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis-of-Design Products: Provide air barrier products manufactured by **Tremco, Inc., Commercial Sealants and Waterproofing Division, An RPM Company**, Beachwood OH; (866) 321-6357; email: [techresources@tremcoinc.com](mailto:techresources@tremcoinc.com); [www.tremcosealants.com](http://www.tremcosealants.com). Comparable products of other manufacturer approved by Architect for bidding shall be in accordance with Section 00 82 00, Special Conditions Article 15, Substitutions.

#### 2.2 MATERIALS, GENERAL

- A. Source Limitations: Obtain air-barrier materials from single source from single manufacturer.
- B. Compatibility: Provide membrane air barrier materials that are compatible with one another and with adjacent materials under conditions of service and application required, as demonstrated by membrane air barrier manufacturer based on testing and field experience.

#### 2.3 PERFORMANCE REQUIREMENTS

- A. General: Membrane air barrier shall be capable of performing as a continuous vapor- permeable air barrier and as a moisture drainage plane transitioned to adjacent flashings and discharging water to the building exterior. Membrane air barriers shall accommodate substrate movement and seal expansion and control joints, construction material transitions, opening transitions, penetrations, and perimeter conditions without moisture deterioration and air leakage exceeding performance requirements.
- B. Air-Barrier Assembly Air Leakage: Maximum **0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa)**, when tested according to ASTM E 2357.
- C. Fire Propagation Characteristics: Provide air barrier system qualified as a component of a comparable wall assembly that has been tested and passed NFPA 285.

## 2.4 MEMBRANE AIR BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: Elastomeric, UV-resistant, synthetic membrane, formulated for application of 48 - (wet), 25 - (dry)
1. **Basis of Design Product: Tremco, Inc., Commercial Sealants and Waterproofing Division, ExoAir 230**, Beachwood OH; (866) 321-6357; email: [techresources@tremcoinc.com](mailto:techresources@tremcoinc.com); [www.tremcosealants.com](http://www.tremcosealants.com), or comparable products of other manufacturer approved by Architect in accordance with Section 00 82 00, Special Conditions, Article 15, Substitutions. If applicable, provide expansion joint products manufactured by Willseal, Hudson, NH; [www.willseal.com](http://www.willseal.com).
  2. Air Permeance, ASTM E 2178: **0.004 cfm/sq. ft of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa)** pressure difference, maximum.
  3. Vapor Permeance, ASTM E 96/E96M: Minimum **12 perms (690 ng/Pa x s x sq. m)**.
  4. Elongation, Ultimate, ASTM D 412, Die C: 600 percent, minimum.
  5. Combustion Characteristics: Class A, flame spread, not greater than 25; smoke developed, not greater than 450, per ASTM E 84.
  6. UV Resistance, QUV-B: Over 160 cycles of UV and water spray with no observable deterioration.
  7. VOC Content: Less than 50 g/L.

## 2.5 ACCESSORY MATERIALS

- A. General: Accessory materials as described in manufacturer's written installation instructions, recommended to produce complete air barrier assembly meeting performance requirements, and compatible with air barrier membrane material and adjacent materials.
- B. Primer: Liquid primer meeting VOC limitations, recommended for substrate by membrane air barrier manufacturer, when installing modified bituminous self-adhered membranes.
1. **Basis of Design Product: Tremco, Inc., ExoAir Primer**
- C. Transitions:
1. **Counterflashing Strip: Modified bituminous, 40 mils (1.0 mm) thick self-adhering composite sheet consisting of 32 mils (0.8 mm) of SBS rubberized asphalt laminated to an 8 mils (0.2 mm) high-density, cross-laminated polyethylene film, for counterflashing of metal flashings and for substrate transitions and for termination of air barrier to bituminous roof membranes and to air barrier terminations at openings.**
    - a. **Basis of Design Product: Tremco, Inc., ExoAir TWF Thru-Wall Flashing.**
  2. **High Temperature Flashing Strip and Underlayment: Butyl, 24 mil thick self-adhering composite sheet consisting of 20 mils of butyl laminated to 4 mil polyethylene film; thermally stable under intermittent, non-continuous exposure up to 240 deg F (115 deg C).**
    - a. **Basis of Design Product: Tremco, Inc., ExoAir 110AT.**
  3. **Flashing Strip: Butyl, 22 mil thick self-adhering composite sheet consisting of 16 mils of butyl laminated to 6 mil polypropylene film; thermally stable under intermittent, non-continuous exposure up to 240 deg F (115 deg C)**
  4. **Opening Transition Assembly: Cured low-modulus silicone extrusion, with reinforcing ribs, sized to fit opening widths, [with aluminum race for insertion into aluminum framing extrusions,] with the following characteristics:**

- a. Basis of Design Product: Tremco, Inc., Proglaze ETA Engineered Transition Assembly. Tear Strength: 110 lb/in (19.3 kN/m)
  5. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with manufacturer's recommended silicone sealant for bonding extrusions to substrates.
    - a. Basis of Design Product: Tremco, Inc.; Spectrem SimpleSeal.
- D. Reinforcing Fabric: High strength mesh fabric consisting of open-weave glass fiber saturated with synthetic resins formulated for high moisture resistance, for reinforcing of liquid applications; not less than 2.5 oz/sq. yd (85 g/sq. m).
  1. Basis of Design Product: Tremco, Inc., Tremco 2011.
- E. Liquid Joint Sealants:
  1. ASTM C 920, single-component polyurethane, approved by air barrier manufacturer for adhesion and compatibility with membrane air barrier and accessories.
    - a. Basis of Design Product: Tremco, Inc., Dymonic 100.
  2. ASTM C 920, single-component, neutral-curing silicone, approved by air barrier manufacturer for adhesion and compatibility with membrane air barrier and accessories post installation of the membrane.
    - a. Basis of Design Product: Tremco, Inc., Spectrem 1.
- F. Sprayed Polyurethane Foam Sealant: Sprayed Polyurethane Foam Sealant: Foamed-in-place, 1.5- to 2.0-lb/cu. ft. (24- to 32-kg/cu. m) density, with flame-spread index of 25 or less per ASTM E 162, for filling of gaps at openings and penetrations.
  1. Basis of Design; Tremco Inc., Flexible Low Expanding Foam (LEF)

## 2.6 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which waterproofing manufacturer agrees to furnish waterproofing material to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as specified under normal use within warranty period specified.
  1. Access for Repair: Owner shall provide unimpeded access to the Project and the waterproofing system for purposes of testing, leak investigation, and repair, and shall reinstall removed cladding and overburden materials upon completion of repair.
  2. Cost Limitation: Manufacturer's obligation for repair or replacement shall be limited to the original installed cost of the work.
  3. Warranty Period: Twenty (20) years following date of Substantial Completion.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Surface Condition: Before applying air barrier materials, examine substrate and conditions to ensure substrates are fully cured, smooth, clean, dry, and free from high spots, depressions, loose and foreign particles and other deterrents to adhesion, and conditions comply with manufacturer's written recommendations.

1. Verify concrete and masonry surfaces are visibly dry, have cured for time period recommended by membrane air barrier manufacturer, and are free from release agents, curing agents, and other contaminants.
2. Test for capillary moisture by method recommended in writing by air barrier manufacturer..
3. Verify masonry joints are filled with mortar and struck flush.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INTERFACE WITH OTHER WORK

A. Commencement of Work: Commence work once air barrier substrates are adequately protected from weather and will remain protected during remainder of construction.

B. Sequencing of Work: Coordinate sequencing of air barrier work with work of other sections that form portions of building envelope air barrier to ensure that flashings and transition materials can be properly installed and inspected. Roofing systems shall be capped and sealed, or top of walls protected, in such a way as to eliminate the ability of water to saturate the wall or interior space, both before and after, air barrier system installation. Coordinate installation of EXOAIR® 230 with the roofing trade to ensure compatibility and continuity with the roofing system.

C. Subsequent Work: Coordinate air barrier work with work of other sections installed subsequent to air barrier to ensure complete inspection of installed air barrier and sealing of air barrier penetrations necessitated by subsequent work.

### 3.3 PREPARATION

A. Clean, prepare, and treat substrate in accordance with air barrier manufacturer's written instructions.

1. Mask adjacent finished surfaces.
2. Remove contaminants and film-forming coatings from substrates.
3. Remove projections and excess materials and fill voids with substrate patching material.
4. Prepare and treat joints and cracks in substrate per ASTM C 1193 and membrane air barrier manufacturer's written instructions.

### 3.4 APPLICATION OF ACCESSORY MATERIALS

A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions. Install transition materials and other accessories to form connect and seal membrane air barrier material to adjacent components of building air barrier system, including, but not limited to, roofing system air barrier, exterior fenestration systems, door framing, and other openings.

B. Primer: Apply primer to substrates when recommended by air barrier manufacturer at required rate for those substrates that will be receiving a modified bituminous self-adhered membrane. Reprime areas not covered within 24 hours.

C. Assembly Transitions: Connect and seal exterior wall air barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

1. Opening Transitions: Fill gaps at perimeter of openings with foam sealant and apply approved transition or accessory material
2. Penetrations: Fill gaps at perimeter of penetrations with foam sealant and level with approved sealant. or seal transition strips around penetrating objects and terminate with approved sealant.

3. Joints: Bridge and cover isolation joints, expansion joints, and discontinuous joints between separate assemblies utilizing approved transition or accessory materials.
  4. Changes in Plane: Apply approved sealant beads at corners and edges to form smooth transition.
  5. Substrate Gaps: Cover gaps with stainless steel sheet mechanically attached to substrate and providing continuous support for air barrier.
- D. Flashings: Seal top of through-wall flashings to membrane air barrier with a continuous bead of approved sealant recommended by air barrier manufacturer.
- E. Seal punctures, voids, and seams. Patch with approved transition and accessory materials following air barrier manufacturer's recommendations and extend repair beyond repaired areas to maintain continuity.

### 3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with transition materials and accessories to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
- B. Membrane Air Barrier: Apply fluid air barrier material in full contact with substrate to produce a continuous seal according to membrane air barrier manufacturers written instructions.
1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, **-in a range of 25 – 35 mils (1.0-mm)** dry film thickness depending on substrate, applied in one or more equal coats, roller- or spray- applied.
- C. Connect and seal exterior wall air-barrier membrane continuously to subsequently-installed roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, wall openings, and other construction used in exterior wall openings, using approved transitions and accessory materials.
- D. Wall Openings: Apply approved sealant to adhere silicone extrusion to perimeter of windows, curtain walls, storefronts, doors, and louvers. Apply [opening transition assembly] [preformed silicone sealant extrusion] according to air barrier transition manufacturer's written instructions.
- E. Seal punctures, voids, and seams. Patch with approved transition and accessory materials following air barrier manufacturer's recommendations and extend repair beyond repaired areas to maintain continuity.
- F. Do not cover air barrier until it has been tested and inspected by Architect.
- G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

### 3.6 CLEANING AND PROTECTING

- A. Clean spills, stains, and overspray resulting application utilizing cleaning agents recommended by manufacturers of affected construction. Remove masking materials.
- B. Protect membrane air barrier from damage from subsequent work. Protect membrane materials from exposure to UV light for period in excess of that acceptable to membrane air barrier manufacturer; replace overexposed materials and retest.

END OF SECTION 07 27 26.03

## SECTION 07 54 16 - ETHYLENE INTERPOLYMER (KEE) ROOFING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. Section Includes:

1. Mechanically Fastened KEE membrane roof system at insulated light-weight concrete decks.
2. Fully adhered KEE roof membrane system at concrete masonry unit parapet walls above insulated concrete decks.

B. Related Sections:

1. Section 03 52 16, "Cellular Lightweight Insulating Concrete" for roof deck.
2. Section 07 27 26 "Fluid-Applied Membrane Air Barriers, Vapor Permeable" for roofing underlayment.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
4. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

#### 1.3 DEFINITIONS AND REFERENCES

- A. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. References:

1. ASTM D6754 Standard Specification for Ketone Ethylene Ester Based Sheet Roofing
2. ASTM D 751 Test Methods for Coated Fabrics
3. Seaman Corporation / FiberTite General Guide Specification FTR GS04/08
4. UL 790 Underwriters Laboratories (UL) - Fire Hazard Classifications
5. FM 4470 GM Global (FM) - Roof Assembly Classifications
6. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual
7. SMACNA's "Architectural Sheet Metal Manual"

#### 1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7. Based on NOA 11-0517.12 & 11-0517.14
1. Uplift Pressures: Ultimate Design Wind Speed to be 200 mph, Exposure C, Risk Category IV.

- D. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- E. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work:
  - 1. Base flashings and membrane terminations.
  - 2. Secondary waterproof membrane to meet code.
  - 3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
  - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
  - 1. Submit evidence of compliance with performance requirements.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
- D. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.
- E. Field quality-control reports.
- F. Warranties: Sample of special warranties.

#### 1.7 CLOSEOUT SUBMITTALS

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

#### 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
- C. Source Limitations: Obtain components including roof insulation fasteners for membrane roofing system approved by membrane roofing manufacturer.
- D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- E. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.



3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

F. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing. Perform pull-out tests.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation. Include protection to restrict any cutting of materials on the roofing membrane.
9. Review roof observation and repair procedures after roofing installation.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

## 1.10 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

## 1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
  - 1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of the roofing system associated with the membrane roof.
  - 2. Warranty Period: Twenty (20) Year No Dollar Limit Roofing Guarantee (Labor and Materials).

## PART 2 - PRODUCTS

### 2.1 KEE MEMBRANE ROOFING

- A. KEE Sheet: ASTM D 6754, fabric reinforced smooth and fleece back,
  - 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. Cooley Engineered Membranes; Div. of Cooley Group. (60 mil)
    - b. Sarnafil, Silka Corporation U.S.(60 mil)
    - c. Seaman Corporation. (Basis of Design - FiberTite- 45 mil E.I.P. Roofing System)
  - 2. Thickness: 45 mils (for FiberTite, and 60 mils for all others), nominal for field and flashing sheets, 36 mils nominal for sacrificial protection sheets.
  - 3. Exposed Face Color: off-white.
  - 4. Provide slip sheet as required by manufacturer.
  - 5. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

### 2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
  - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction and be compatible with fluid-applied underlayment and slip sheet.
  - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Plastic Foam Adhesives: 50 g/L.
    - b. Multipurpose Construction Adhesives: 70 g/L.
    - c. Fiberglass Adhesives: 80 g/L.
    - d. Single-Ply Roof Membrane Adhesives: 250 g/L.
    - e. Other Adhesives: 250 g/L.
    - f. PVC Welding Compounds: 510 g/L.
    - g. Adhesive Primer for Plastic: 650 g/L
    - h. Single-Ply Roof Membrane Sealants: 450 g/L.
    - i. Non-membrane Roof Sealants: 300 g/L.
    - j. Sealant Primers for Nonporous Substrates: 250 g/L.
    - k. Sealant Primers for Porous Substrates: 775 g/L.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as KEE sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard, water based (fleece back), and low VOC solvent based (flashings).
- D. Slip Sheet: Manufacturer's standard, of thickness required for application.

- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel bars, approximately 1 by 1/8 inch thick; with anchors.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.
- H. The specified membrane roofing system must consist of the materials required and be installed under the following criteria.
  - 1. UL Listing; provide materials bearing Underwriters Laboratories (UL) marking / label on the packaging or containers indicating materials have been produced under UL classification and follow-up services.
  - 2. FM Listing; provide membrane roofing system and materials that have been evaluated by FM Global (FM) for spread of flame, seam leakage, hail resistance and wind uplift. Identify materials with FM Approved marking / label.
    - a. Fire/Windstorm Classification: FM 1-90
    - b. Hail Resistance: SH

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
  - 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
  - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
  - 3. Verify that surface plane flatness and fastening of membrane complies with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

#### 3.3 WOOD NAILERS

- A. Wood shall be No. 2 or better construction grade lumber.
- B. Creosote or asphaltic type preservatives are not acceptable.
- C. Minimum nailers shall be at least 3½ inches wide and 1 1/2 inches high and installed and anchored in such a manner to resist a force of 250 lbs. per linear foot of wood blocking in any direction.
- D. Install treated lumber at the same heights as insulation layer or adjacent construction ± 1/4 inch. Continuous treated wood nailers are to be installed at all perimeters, around roof projections and

penetrations as shown in approved details. Where wood nailers are installed directly on the substrate, the substrate shall be carefully examined to confirm that the entire area provides a suitable fastening surface. All defects shall be repaired by the appropriate trade prior to installation.

### 3.4 MEMBRANE INSTALLATION

#### A. Quality Control:

1. It will be the responsibility of the roofing contractor to initiate and maintain a QC program to govern all aspects of the installation of the Membrane Roofing System.
2. The project foreman and or supervisor will be responsible for the daily execution of the QC program which will include but is not limited to the supervision, inspection and probing of all heat welding incorporated within the Membrane Roofing System.
3. If inconsistencies in the quality of the application of the composite, membrane and/or welds are found, all work shall cease until corrective actions are taken to ensure the continuity the installation.

#### B. General:

1. Work shall be coordinated to ensure that sequencing of the installation promotes a 100% watertight installation at the end of each day.
2. Restrictions regarding outside ambient air temperature are relative only to the exposure limits of the workers and/or adhesives.
3. When using adhesives outside ambient air temperature shall be above 40°. Curing or drying time of the adhesive will be affected by ambient temperatures and must be taken into consideration when determining flashing lengths.
4. Humidity can effect the drying time of solvent borne adhesives and/or cause condensation to form on the newly applied adhesive.
5. Moisture may not be present on the adhesive prior to mating or application of Membrane Roofing System.
6. New Membrane Roofing Systems shall only be installed over properly prepared and sound substrates, free from excessive surface roughness, dirt, debris and moisture.

### 3.5 MEMBRANE SECUREMENT

- A. The properly positioned membrane shall be attached using FTR Magnum Fasteners and Magnum Stress Plates installed through the membrane and insulation assembly and engage the structural decking.
- B. The Magnum stress plates shall be installed straight and parallel to existing structural purlin members. All stress plates must set completely on the membrane allowing a minimum of 1/2 inch from the edge and allow sufficient room to facilitate welding.
- C. Fastener row spacing and intervals shall be established to resist design pressures, determined in compliance with procedures outlined within the current publication of ASCE Standard 7. Alternative designs may be determined using the criteria within Factory Mutual Research Loss Prevention Data.
- D. Perimeter zone and corner zone enhancement is required on all mechanically fastened roofing systems. Perimeters and corners are defined as follows:
- E. Perimeter: 10% of the width of the roof areas or 40% of the height of the roof area, whichever is less to a minimum of 4-ft. Perimeter zones run parallel to all external roof edges including those with parapet walls.
- F. Corner zones are the square intersection of perimeters.
- G. Projects having variable roof levels shall treat the outer boundary of each level as a perimeter. Internal expansion joints, firewalls or adjoining building walls greater than 3 feet are not considered perimeter areas.
- H. Perimeters and corners may be enhanced by:
  1. Installing "half" rolls of membrane fastened as prescribed by project requirements.
  2. Adding additional rows of fasteners through the top of the membrane system within the perimeter at prescribed intervals area and sealing with a 6 inch strip.

### 3.6 HOT AIR WELDING

#### A. General:

1. All field seams exceeding 10 feet in length shall be welded with an approved automatic welder.
2. All field seams must be clean and dry prior to initiating any field welding.
3. All welding shall be performed only by qualified personnel to ensure the quality and continuity of the weld.

#### B. Hand Welding:

1. The lap or seam area of the membrane should be intermittently tack welded to hold the membrane in place.
2. Properly hand welded seams shall utilize a 1-1/2 inch wide nozzle, to create a homogeneous weld, a nominal 1-1/2 inches in width.

#### C. Automatic Machine Welding:

1. Follow all manufacturers' instructions for the safe operation of the automatic welder.
2. Follow local code requirements for electric supply, grounding and surge protection.
3. Properly Automatic Machine welded seams shall utilize a 1-1/2 inch wide nozzle, to create a homogeneous weld, a nominal 1-1/2 inches in width.

### 3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

### 3.8 SEALANTS

- A. Apply authorized sealant(s) to all surface mounted reglets and per project requirements. Sealant(s) are to shed water. Follow all manufacturer's instructions and installation guides.
- B. Use primer when recommended by the manufacturer.

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- D. Remove and replace roofing components that show an indication that membrane materials have been cut on top of other membranes.
- E. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.10 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

### 3.11 WARRANTY INSPECTION

- A. Upon completion of the project, the authorized roofing contractor shall complete and submit the MRSM Project Completion Notice.
- B. Upon receipt of the notice of completion, a Technical Representative of the MRSM shall schedule an inspection with a representative of the authorized roofing contractor to thoroughly review the installation and verify compliance with MRSM specifications.
- C. Any corrections or modifications necessary for compliance with the specifications and acceptance for warranty (punch list) will be noted on the Final Inspection for Warranty Form.
- D. Upon completion of all punch list items and final acceptance of the installation, a warranty as authorized by the MRSM will be issued.

END OF SECTION 075416

## SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

##### A. Section Includes:

1. Manufactured Products: Products shall be manufactured by, or approved for installation with, the metal roofing system and/or the membrane roofing system. Products provided for the metal roofing system shall match the material and color of the selected roofing system.
  - a. Manufactured through-wall flashing and counterflashing.
  - b. Manufactured reglets, flashings and counterflashing.
  - c. Manufactured copings.
2. Formed Products: Products shall be formed by, or approved for installation with, the metal roofing system and/or the membrane roofing system. Products provided for the metal roofing system shall match the material and color of the selected roofing system.
  - a. Formed roof drainage sheet metal fabrications.
  - b. Formed sloped roof sheet metal fabrications.
  - c. Formed equipment support flashing.

##### B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Ethylene Interpolymer (KEE) Roofing " for installing sheet metal flashing and trim integral with membrane roofing.
3. Division 07 Section "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
4. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. SPRI Wind Design Standard: Manufacture and install [copings] [roof edge flashings] tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
  1. Ultimate Design Wind Speed: 200 mph, Exposure C, Risk Category IV.
- C. FM Approvals Listing: Manufacture and install copings and roof drainage and flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-200. Identify materials with name of fabricator and design approved by FM Approvals.
- D. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
  1. Identification of material, thickness, weight, and finish for each item and location in Project.
  2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
  3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  4. Details of termination points and assemblies, including fixed points.
  5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
  6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
  7. Details of special conditions.
  8. Details of connections to adjoining work.
  9. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.
- C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  1. Sheet Metal Flashing: 8 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
  2. Trim, Coping, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 8 inches long and in required profile. Include fasteners and other exposed accessories.
  3. Accessories and Miscellaneous Materials: Full-size Sample.
- E. Qualification Data: For qualified fabricator.
- F. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are specified or shown on Drawings.
- 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 eave, including fascia and fascia trim, approximately 10 feet long, including supporting construction cleats, seams, attachments 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.

D. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

## PART 2 - PRODUCTS

### 2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A 480/A 480M, Type 304, dead soft, fully annealed.
  1. Finish: 3 (coarse, polished directional satin).
  2. Surface: Smooth, flat.
- C. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
  1. Aluminum Pre-Finished: 0.040 inch thick, white color.
  2. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (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.
  3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

### 2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
  - 1. General: Blind fasteners or self-drilling stainless steel screws, gasketed, with hex-washer head.
    - a. Blind Fasteners: High-strength stainless-steel rivets suitable for metal being fastened.
  - 2. Fasteners: Series 300 stainless steel.
- C. Solder:
  - 1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
  - 2. For Aluminum: AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application and compatible with roof membrane system.

## 2.3 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
  - 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. Cheney Flashing Company.
    - b. Fry Reglet Corporation.
    - c. Heckmann Building Products Inc.
    - d. Hickman, W. P. Company.
    - e. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
    - f. Keystone Flashing Company, Inc.
    - g. National Sheet Metal Systems, Inc.
    - h. Sandell Manufacturing Company, Inc.
    - i. Boss Metals, Inc.
  - 2. Material: Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.
  - 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
  - 4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
  - 5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
  - 6. Accessories:
    - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
    - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
  - 7. Finish: With manufacturer's standard color coating.

## 2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
  - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  - 2. Obtain field measurements for accurate fit before shop fabrication.
  - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- G. Do not use graphite pencils to mark metal surfaces.

## 2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Conductor Heads (As shown on Drawings): Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
  - 1. Fabricate from the following materials:
    - a. Aluminum Pre-Finished: 0.040 inch thick.
- B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
  - 1. Fabricated Hanger Style: SMACNA figure designation 1-35B or 1-35H.
  - 2. Provide square-to-round transition at each storm drain connection.
  - 3. Fabricate from the following materials:
    - a. Aluminum Pre-Finished: 0.040 inch thick.
- C. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
  - 1. Aluminum Pre-Finished to match roofing: 0.040 inch thick.

## 2.6 ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
    - 1. Coping Profile: SMACNA figure designation 3-4A, 3-4D, 3-4G.
    - 2. Joint Style: Butt, with 12-inch- wide, concealed backup plate and 6-inch- wide, exposed cover plates.
    - 3. Fabricate welded corners and intersections to accommodate conditions.
    - 4. Fabricate from the following materials:
      - a. Aluminum Pre-Finished to match roofing: 0.040 inch thick.
  - B. Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following materials:
    - 1. Stainless Steel: 0.025 inch thick.
  - C. Base Flashing: Fabricate from the following materials:
    - 1. Aluminum: 0.040 inch thick.
  - D. Counterflashing: Fabricate from the following materials:
    - 1. Aluminum Pre-Finished to match roofing: 0.040 inch thick.
  - E. Flashing Receivers: Fabricate from the following materials:
    - 1. Aluminum Pre-Finished to match roofing: 0.040 inch thick.
  - F. Roof-Penetration Flashing: Fabricate from the following materials:
    - 1. Stainless Steel: 0.025 inch thick.
- 2.7 MISCELLANEOUS SHEET METAL FABRICATIONS
- A. Equipment Support Flashing: Fabricate from the following materials:
    - 1. Stainless Steel: 0.025 inch thick.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
  4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
  5. Install sealant tape where indicated.
  6. Torch cutting of sheet metal flashing and trim is not permitted.
  7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Coat back side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance meeting specified wind loads.
- E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F , set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
  2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches , except reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel sheet.
  2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
  3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

### 3.3 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Downspouts: Join sections with 1-1/2-inch telescoping joints.
1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 48 inches o.c. in between.
  2. Connect downspouts to underground drainage system indicated.

- C. Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
  - 1. Anchor scupper closure trim flange to exterior wall and solder or seal with elastomeric sealant to scupper.
  - 2. Loosely lock front edge of scupper with conductor head.
- D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.
- E. Provide square-to-round transition at each storm drain connection.

### 3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as required by design wind loads if not indicated on drawings. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at intervals as calculated by engineer that is to provide roofing and flashing shop drawings.
- D. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind loads as noted above.
- E. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- F. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.
- G. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

### 3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

### 3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

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## **SECTION 07 72 00 - ROOF ACCESSORIES**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Roof curbs.
- 2. Equipment supports.
- 3. Pipe supports.
- 4. Preformed flashing sleeves.

- B. Related Sections:

- 1. Division 03 Section 03 52 16 "Cellular Lightweight Insulating Concrete" for sloped to drain roof deck.
- 2. Division 03 Section 03 40 00 "Precast, Prestressed Hollow Core Plank" for structural deck.
- 3. Division 05 Section "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
- 4. Division 07 Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, copings, and miscellaneous sheet metal trim and accessories.
- 5. Division 07 Section 07 54 16 "Ketone Ethylene Ester Roofing" for roof membrane system.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Provide fabricated systems that are identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7. Based on NOA 11-0517.12 & 11-0517.14
  - 1. Ultimate Design Wind Speed to be 200 mph, Exposure C, Risk Category IV.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.
- D. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
  - 1. Size and location of roof accessories specified in this Section.
  - 2. Size and location of safety tie-off system at metal roof.
  - 3. Method of attaching roof accessories to roof or building structure.
  - 4. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
  - 5. Required clearances.
  - 6. All calculations for safety and support systems shall be signed and sealed by a Florida Registered Engineer.
- E. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

## 1.5 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

## PART 2 - PRODUCTS

### 2.1 METAL MATERIALS

- A. Aluminum Sheet: ASTM B 209 , manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
  - 1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.040 inch or thicker.
- B. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished. 0.050 inch minimum thickness or thicker if required to meet performance requirements.
- C. Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZM150 coating designation 0.032 inch minimum thickness or thicker if required to meet performance requirements.
- D. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304 0.032 inch minimum thickness or thicker if required to meet performance requirements.

### 2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187 and as compatible with roof membrane system.
- E. Underlayment: Section 07 27 26.03, Fluid Applied Waterproofing. Alternate, Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
  - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F .
  - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F .
  - 3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
    - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
    - c. Metal-Fab Manufacturing, LLC; MetShield.
    - d. Owens Corning; WeatherLock Metal High Temperature Underlayment.
  - 4. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
  - 5. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.
- F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
  - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel.
  - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
  - 3. Anchor design shall resist loads and wind speed design specified.
- G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- H. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.3 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units with integral spring-type vibration isolators and capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
  - 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. AES Industries, Inc.
    - b. Curbs Plus, Inc.
    - c. Custom Solution Roof and Metal Products.
    - d. Greenheck Fan Corporation.
    - e. LM Curbs.
    - f. Metallic Products Corp.
    - g. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
    - h. Pate Company (The).
    - i. Roof Products, Inc.

- j. Safe Air of Illinois.
  - k. Thybar Corporation.
  - l. Vent Products Co., Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Loads: See roof loading requirements on structural drawings. Anchor design shall resist loads and wind speed design specified.
- D. Material:
- 1. Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZM150 coating designation 0.090 inch thick minimum thickness or thicker if required to meet performance requirements.
  - 2. Series 300 stainless steel thickness required to support loads.
- E. Construction:
- 1. Liner: Same material as curb, of manufacturer's standard thickness and finish.
  - 2. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
  - 3. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
  - 4. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
  - 5. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.

## 2.4 EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
- 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. AES Industries, Inc.
    - b. Curbs Plus, Inc.
    - c. Custom Solution Roof and Metal Products.
    - d. Greenheck Fan Corporation.
    - e. LM Curbs.
    - f. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
    - g. Pate Company (The).
    - h. Roof Products, Inc.
    - i. Thybar Corporation.
    - j. Vent Products Co., Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Loads: See roof loading requirements on structural drawings. Anchor design shall resist loads and wind speed design specified.
- D. Material:
- 1. Aluminum sheet, 0.090 inch thick or thicker as required to support loads. Finish: Clear anodic.
  - 2. Series 300 stainless steel thickness required to support loads.

E. Construction:

1. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
2. Factory-installed continuous wood nailers 3-1/2 inches wide at tops of equipment supports.
3. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
5. Fabricate equipment supports to minimum height of 12 inches unless otherwise indicated.

2.5 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 36 inches high, with removable metal hood and slotted or perforated metal collar.

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. Custom Solution Roof and Metal Products.
  - b. Thaler Metal USA Inc.
2. Metal: Aluminum sheet, 0.063 inch thick. Anchor design shall resist loads and wind speed design specified.
3. Diameter: As required for vent size as indicated on plumbing drawings.
4. Finish: Manufacturer's standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Equipment support and safety tie –off system that use pipe supports tied back to structure can utilize vent-type stack flashing at thru-roof penetrations.
2. 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. Custom Solution Roof and Metal Products.
  - b. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
  - c. Thaler Metal USA Inc.
3. Metal: Aluminum sheet, 0.063 inch thick. Anchor design shall resist loads and wind speed design specified.
4. Height: 13 inches.
5. Diameter: As required for vent size as indicated on plumbing drawings and for pipe sizes at support systems.
6. Finish: Manufacturer's standard.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" 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.

PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
  - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
  - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
  - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
  - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
  - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.
- F. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.
- G. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

### 3.3 REPAIR AND CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.
- B. Clean off excess sealants.
- C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

## **SECTION 07 84 13 - PENETRATION FIRESTOPPING**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Related Sections include the following:
  - 1. Division 07 Section "Fire-Resistive Joint Systems."
  - 2. Division 21 Sections specifying fire-suppression piping penetrations.
  - 3. Division 22 and 23 Sections specifying duct and piping penetrations.
  - 4. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
  - 1. Fire-resistance-rated walls including fire walls fire partitions fire barriers and smoke barriers.
  - 2. Fire-resistance-rated horizontal assemblies including floors floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
  - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling, or exceeding fire-resistance rating of constructions penetrated.
  - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
    - a. Penetrations located outside wall cavities.
    - b. Penetrations located outside fire-resistance-rated shaft enclosures.
  - 3. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings indicated of not more than 3.0 cfm/sq. ft at both ambient temperatures and 400 deg F .
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
  2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
  3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
  1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
  1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
  2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
    - a. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:



1) UL in its "Fire Resistance Directory."

- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.
- C.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated.

2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:

- a. Slag-/rock-wool-fiber insulation.
  - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
  - c. Fire-rated form board.
  - d. Fillers for sealants.
2. Temporary forming materials.
  3. Substrate primers.
  4. Collars.
  5. Steel sleeves.

## 2.3 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

## 2.4 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
  - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
  - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

### 3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
  - 1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Through-penetration firestop system designation of applicable testing and inspecting agency.

4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

### 3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

## SECTION 07 92 00 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
  - 1. Joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Control and expansion joints on exposed exterior and interior surfaces of exterior walls and roofs.
    - b. Perimeter joints of openings and where indicated.
    - c. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
    - d. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - e. Other joints as indicated.
- B. Related Sections include the following:
  - 1. Division 07 Section 07 84 13 "Penetration Firestopping" for sealing joints in fire-resistance-rated construction.
  - 2. Division 07 Section 07 24 00 "Exterior Finish Insulation System" for exterior wall finish system.
  - 3. Division 09 Section 09 29 00 "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
  - 4. Division 09 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.
  - 5. Division 07 Section "Exterior Aluminum Framed Entrances and Storefronts" for sealing perimeter joints.
  - 6. Division 32 Section "Concrete Paving Joint Sealants" for traffic grade joint sealants for concrete paving.

#### 1.3 REFERENCE STANDARDS

- A. ASTM International (ASTM):
  - 1. ASTM C 661 - Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer
  - 2. ASTM C 794 - Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
  - 3. ASTM C834 - Specification for Latex Sealants.
  - 4. ASTM C 920 - Specification for Elastomeric Joint Sealants.
  - 5. ASTM C 1087 - Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
  - 6. ASTM C 1193 - Guide for Use of Joint Sealants.
  - 7. ASTM C 1248 - Test Method for Staining of Porous Substrate by Joint Sealants.

8. ASTM C 1311 - Specification for Solvent Release Sealants.
9. ASTM C 1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
10. ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
11. ASTM D 624 - Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
12. ASTM D 2240 - Test Method for Rubber Property - Durometer Hardness.
13. ASTM E 283 - Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls,  
and Doors Under Specified Pressure Differences Across the Specimen.
14. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by  
Uniform Static Air Pressure Difference.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. 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.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- D. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
  1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- E. Warranties: Sample of special warranties.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.
  - 1. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
  - 2. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. Preconstruction Field-Adhesion Testing: Prior to installing joint sealants, field test adhesion to joint substrates using ASTM C1193 Method A or method recommended by manufacturer. Verify adhesion is adequate. Modify joint preparation recommendations for failed joints and re-test. Submit written report to Architect.
- E. Mockups: Provide joint sealant application within mockups required in other sections identical to specified joint sealants and installation methods.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.8 PROJECT 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.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## 1.9 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Five (5) years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Twenty (20) years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
  - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
  - 2. Disintegration of joint substrates from natural 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 MANUFACTURERS

- A. Basis-of-Design Product: Provide joint sealant products manufactured by The Dow Chemical Company, Midland MI; (877) SEALANT ((877) 732-5268); email: construction@dow.com; dow.com/construction.
- B. Comparable products of other manufacturer approved by Architect at time of bidding in accordance with Special Conditions Section 00 82 00, Article 15, Substitutions.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- D. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
  1. Architectural Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.

### 2.2 MATERIALS, 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 sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
- C. Joint Sealant Standard: Comply with ASTM C 920 and other specified requirements for each liquid-applied joint sealant.
- D. Stain Test Characteristics: Where sealants are required to be nonstaining, provide sealants tested per
- E. ASTM C 1248 as non-staining on porous joint substrates indicated for Project.
- F. Food Contact Suitability: Where sealants are required to be suitable for contact with food provide sealants complying with 21 CFR 177.2600.

### 2.3 LIQUID JOINT SEALANTS

- A. FOR ALL EXTERIOR BUILDING SEALANTS AND INTERIOR SIDES OF EXTERIOR WALLS: Silicone Building Sealant - a one-component, medium modulus, neutral-cure, silicone sealant for structural and non-structural attachment for panel systems, as well as above-grade weathersealing joints with most common constructions materials for both new and remedial construction. Product complies with GSA Commercial Item Descriptions CID A-A-272B. Volatile Organic Compound (VOC) Content: 32 g/L maximum.

Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT, G, A, and O; SWRI validation.

1. Basis of Design Product: DOWSIL™ 795 Silicone Building Sealant.
2. Hardness, ASTM C 661: 35 - 45 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 32 g/L maximum
4. Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturers full line of not less than 10 colors.



- B. FOR ALL EXTERIOR GLAZING SYSTEMS: Silicone Structural Sealant - designed for excellent adhesion in structural applications, including factory or field glazing. It adheres to glass, reflective glass, anodized aluminum, granite and most paints, including fluoropolymer-based paints. It exhibits a medium modulus, which offers an extremely high tensile adhesion strength. Ideal for use as a glazing sealant in high-performance protective window systems that increase personal safety from flying glass. Tolerates the differential thermal and wind load movements found in structural glazing applications and the severe stresses required of an impact-resistant glazing product. Product complies with GSA Commercial Item Descriptions CID A-A-272B. Volatile Organic Compound (VOC) Content: 34 g/L maximum.

Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT; SWRI validation.

1. Basis of Design Product: DOWSIL™ 995 Silicone Structural Sealant.
2. Hardness, ASTM D 2240: 35 - 45 durometer Shore A
3. Volatile Organic Compound (VOC) Content: 34 g/L maximum
4. Ultimate Tensile, ASTM C 1135: 160 psi (1.1 MPa), at 21 day cure (TA Joint).
5. Color: As selected by Architect from manufacturers full line of not less than 3 colors.

- C. FOR ALL WEATHER BARRIER APPLICATIONS: a one-component, neutral-cure silicone sealant for above-grade joints with compatibility and strong adhesion to a wide array of common construction materials, including peel-and-stick window flashings, building wraps, polyolefins, and PVCs for both new and remedial construction. Volatile Organic Compound (VOC) Content: 61 g/L.

Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant JS# \_\_: ASTM C 920, Type S, Grade NS, Class 25, for Use NT; SWRI validation.

1. Basis of Design Product: DOWSIL™ 758 Silicone Weather Barrier Sealant.
2. Hardness, ASTM D 2240: 45 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 61 g/L maximum
4. Color: White.

- D. FOR ALL NON-FOOD AREA INTERIOR WET APPLICATIONS: a one-component, silicone rubber sealant that is mildew resistant when cured and is suitable for sealing tubs, showers, sinks, porcelain, cultured marble, glass, painted areas, and other nonporous surfaces and plumbing fixtures for both new and remedial construction. 786 is available in clear, white, translucent white, gray, and almond. Not for use in contact with brass or copper. Mildew resistance is established by manufacturer based upon several test methods; Volatile Organic Compound (VOC) Content: 36 g/L maximum.

Mildew-Resistant, Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant JS# \_\_: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Basis of Design Product: **DOWSIL™ 786 Silicone Sealant**.
2. Hardness, ASTM D 2240: 25 durometer Shore A
3. Volatile Organic Compound (VOC) Content: 36 g/L maximum.
4. NSF Standard 51 and FDA Regulation No. 21 CFR 177.2600 compliant.
5. Color: As selected by Architect from manufacturer's standard colors.

- E. FOR ALL INTERIOR NON-MOVING PAINTABLE JOINTS: Latex Joint Sealants and Butyl-Rubber Based Joint Sealant are available from a variety of manufacturers. Butyl rubber joint sealant is specified for interior concealed joints within metal assemblies.

1. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
2. Butyl-Rubber-Based Joint Sealants: ASTM C1311

- F. FOR ALL INTERIOR DETENTION AREAS: tamper-proof Sealants are available from a variety of manufacturers. Sealants should be applied after painting.
1. Basis of Design Product: **Pecora 896HIS**, high impact silicone.
  2. Hardness, ASTM C 661: 45 durometer Shore A
  3. Volatile Organic Compound (VOC) Content: 121 g/L maximum.
  4. Color: As selected by Architect from manufacturer's standard colors.

## 2.4 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F . Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.5 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 joint-sealant performance.
- 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 nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
  - a. Metal.
  - b. Glass.

- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on 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 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 type 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 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- G. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

3.4 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.

3.5 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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

## SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Bullet resistant doors and frames.
3. Louvers installed in hollow metal doors.

B. Related Sections:

1. Division 03 Section "Insulating Concrete Forms" for anchors for hollow metal work into concrete wall construction.
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ANSI/SDI A250.13 - Testing and Rating of Severe Windstorm Resistant Components for Swing Door Assemblies.
7. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
8. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
9. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
10. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
11. ASTM E1886 - Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
12. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes.
13. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
14. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
15. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
16. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.

17. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
18. TAS-201-94 - Impact Test Procedures.
19. TAS-202-94 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components using Uniform Static Air Pressure.
20. TAS-203-94 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.
21. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
22. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
23. UL 752 – Standard for Bullet Resistant Materials.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
  1. Elevations of each door design.
  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 anchorages, joints, field splices, and connections.
  6. Details of accessories.
  7. Details of moldings, removable stops, and glazing.
  8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
  1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.
- E. Informational Submittals:
  1. Hurricane Resistant Openings (State of Florida): Within the State of Florida, provide copy of current State of Florida Product Approval or Metro-Dade County Notice of Acceptance (NOA) as proof of compliance that doors, frames and hardware for exterior opening assemblies have been tested and approved for use at the wind load and design pressure level requirements specified for the Project.
    - a. Hurricane Resistant Components (State of Florida): Within the State of Florida, provide copy of independent, third party certified listing conforming to ANSI A250.13.
    - b. Applies to all exterior doors and frames.
  2. Bullet Resistant Openings: Certified and third-party tested in accordance with UL752 and NIJ standards.

### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
  - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
  - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, 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.
  - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
    - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Hurricane Resistant Exterior Openings (State of Florida including High Velocity Hurricane Zone (HVHZ): Provide exterior hollow metal doors and frames as complete and tested assemblies, or component assemblies, including approved hardware specified under Section 087100 "Door Hardware", to meet the wind loads, design pressures, debris impact resistance, and glass and glazing requirements as detailed in the current State of Florida building code sections applicable to the Project.
  - 1. Each unit to bear third party permanent label in accordance with Florida Building Code requirements.
- F. Bullet Resistant Openings: Assemblies tested by third-party in accordance with UL752 and NIJ standards. Bullet protection ratings for UL752 levels 4-8 rifles.
- G. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

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

1.7 COORDINATION

- A. Coordinate installation of anchorages 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
  - 1. CECO Door Products (C).
  - 2. Curries Company (CU).
  - 3. Pioneer Industries (PI).
  - 4. Steelcraft (S).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  - 1. Design: Flush panel.



2. Core Construction: Manufacturer's standard vertical steel-stiffener core. Minimum 22 gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
  3. **Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.**
  4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
  5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
  6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
  7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
  2. Core Construction: Manufacturer's standard vertical steel-stiffener core. Minimum 22 gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
    - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
  3. **Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.**
  4. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
  5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
  6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
  7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- A. Interior Bullet Resistant Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
  2. Core Construction: Manufacturer's standard vertical steel-stiffener core. Minimum 18 gauge steel-stiffeners as required for rating. Spaces between stiffeners filled with proprietary bullet resistant core.
    - a. Bullet Resistant Door Core: Steel stiffened with proprietary ballistic tested core for levels 4-8.
  3. Level/Model: HPR Level 8 and Physical Performance Level A (Extra Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel reinforcing and 14 gauge face skin.

4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 12 gauge, extending the full width of the door and welded to the face sheet.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" with minimum 18 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets unless noted.
7. 12-inch x 12-inch vision panel (FV1) 12-gauge window sub-channel.

B. Manufacturers Basis of Design:

1. Curries Company (CU) - Steel-Stiffened - 747 Series.
2. Bullet Resistant Assemblies: (CU) – Steel Stiffened – 737 Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: **Minimum 16 gauge** (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

- a. Curries Company (CU) – M Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: **Minimum 16 gauge** (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

- a. Curries Company (CU) - M Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

F. Interior Bullet Resistant Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (1.9-mm) thick steel sheet continuous hinge.
3. Manufacturers Basis of Design:

- a. Curries Company (CU) – M or G Series.
- b. Bullet Resistant (for UL752 levels 4-8) –14-gauge frames with bullet resistant core.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, 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.

2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Windstorm Opening Anchors: Types as tested and required for indicated wall types to meet specified wind load design criteria.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.6 LOUVERS:

A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

## 2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Louvers: Factory cut openings in door and install louvers into prepared openings where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

2. Welded Frames: Weld joints continuously through full throat width of frames, including rabbets, soffits, and stops; grind, fill, dress, and make smooth, flush, and invisible.
    - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
  3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
  4. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
  5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  6. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.
      - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
    - c. Severe Storm Shelter Openings: Provide jamb, head, and sill anchors in accordance with manufacturer's tested and approved assemblies.
    - d. Bullet Resistant Openings: Provide 14-gauge stiffener welded to frame for 3/8" bolt to 14-gauge full-height jamb reinforcement plate.
  7. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

## 2.9 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.
  - 2. Coating: Apply bituminous coating or automotive undercoating spray coat to inside of frames at all exterior door locations.

## 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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. 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.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
  - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
  - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.

4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

### 3.4 ADJUSTING AND CLEANING

- A. 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.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 08 11 13

## SECTION 08 14 16 - FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

##### A. Section Includes:

1. Solid-core doors and transom panels with wood-veneer faces.
2. Factory finishing flush wood doors and transom panels.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

##### B. Related Sections:

1. Division 08 Section "Interior Aluminum Framed Entrances & Storefronts" for requirements for flush wood doors in aluminum frames.
2. Division 08, "Hollow Metal Doors and Frames" for requirements for flush wood doors in hollow metal frames.
3. Division 08 Section "Glazing" for glass view panels in flush wood doors.
4. Division 08 Section "Door Hardware" for hardware requiring factory fitting.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  1. Indicate dimensions and locations of mortises and holes for hardware.
  2. Indicate dimensions and locations of cutouts.
  3. Indicate requirements for veneer matching.
  4. Indicate doors to be factory finished and finish requirements.
  5. Indicate fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:
  1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
  2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
    - a. Provide samples for each species of veneer and solid lumber required.
    - b. Provide samples for each color, texture, and pattern of plastic laminate required.
    - c. Finish veneer-faced door samples with same materials proposed for factory-finished doors.

3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.
- C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated." or WDMA I.S.1-A, "Architectural Wood Flush Doors."
  1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
  2. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
  3. Provide WI-Certified Compliance Certificate for installation.
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are 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.
  1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- E. Preinstallation Conference: Conduct conference at Project site.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.



2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

## 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. Buell Door Company Inc.
  2. Chappell Door Co.
  3. Eagle Plywood & Door Manufacturing, Inc.
  4. Eggers Industries.
  5. Graham; an Assa Abloy Group company.
  6. Ideal Architectural Doors & Plywood.
  7. Ecker Doors, a Division of Engineered Group
  8. VT Industries Architectural Wood Doors (Basis of Design)

### 2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-2.
  2. Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
  3. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
  4. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- C. Structural-Composite-Lumber-Core Doors:
1. Structural Composite Lumber: WDMA I.S.10.
    - a. Screw Withdrawal, Face: 700 lbf .
    - b. Screw Withdrawal, Edge: 400 lbf .
- D. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
  2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Comply with specified requirements for exposed edges.
  3. Pairs: Provide formed-steel edges and astragals.
    - a. Finish steel edges and astragals with baked enamel.
- E. Mineral-Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.

2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

## 2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors Basis of Design: VT Industries; Color: provide range to be selected.

1. Grade: Premium, with Grade A faces.
2. Species: Provide range of species to be selected by Owner/Architect.
3. Cut: Plain slice
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Transom Match: Continuous match.
8. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Division 06 Section "Interior Architectural Woodwork."
9. Exposed Vertical and Top Edges: Same species as faces.
10. Core: Particleboard, glued wood stave or structural composite lumber. Mineral or wood core at fire rated doors.
11. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.

## 2.4 LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

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. Air Louvers Inc.
  - b. Anemostat; a Mestek company.
  - c. Hiawatha Incorporated.
  - d. L & L Louvers, Inc.
  - e. LL Building Products, Inc.; a division of GAF Materials Corporation.
  - f. Louvers & Dampers, Inc.; a Mestek company.
  - g. McGill Architectural Products.
2. Blade Type: Vision-proof, inverted Y.
3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, with powder coated finish.

B. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.

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. Air Louvers Inc.
  - b. Anemostat; a Mestek company.
  - c. Hiawatha Incorporated.
  - d. L & L Louvers, Inc.
  - e. LL Building Products, Inc.; a division of GAF Materials Corporation.
  - f. Louvers & Dampers, Inc.; a Mestek company.
  - g. McGill Architectural Products.
2. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, with powder-coated finish.

- C. Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; with powder-coated finish; and approved for use in doors of fire-protection rating indicated.

## 2.5 AUTOMATIC DOOR BOTTOM

- A. Mounting: Surface-mounted
- B. Seal:
  - 1. Actuated by an adjustable operating rod that seals automatically when the door contacts the hinge jamb seal retainer. The door bottom mechanism must drop first at the hinge edge of the door and then continue to drop towards the lock edge of door as the door continues to swing shut. The seal must be self-centering to a flat-plate threshold to provide a proper seal across the entire door width if the floor surface is not entirely even. Automatic door bottom mechanism shall have only one moving part and shall not utilize any plastic parts, lever mechanism or actuation at both the lock edge and hinge edge of door.
  - 2. Gasket material to be a solid extruded high grade neoprene bulb. Door bottom is to utilize neoprene seals inside the mechanism to prevent sound from "flanking" through mechanism.
  - 3. Housing: Extruded aluminum, minimum wall thickness of .093".
- C. The following products are acceptable:
  - 1. #367 (surface mounted) from Zero International, Inc., Bronx, NY, 800-635-5335
  - 2. Products manufactured by Reese Enterprises, Inc., or National Guard Products that meet the above requirements may be submitted for approval.

## 2.6 HEAD & JAMB ADJUSTABLE SEAL

- A. Adjustable door stop constructed of extruded aluminum housing of thickness 0.093 inches. Adjusting screws shall be provided 12 inch O.C., giving an adjusting range of 0.310. Adjusting screws shall be #8 x1 1/2" stainless steel, shall have a special shoulder for retaining clip, and shall be held in the assembly by a retainer clip. Adjusting screw must engage a solid adjusting channel which has been drilled and tapped to provide a complete circumference engagement for screw thread. No spring retainers, self tapping adjusting screws, or channels which do not contain a drilled and tapped hole for the adjusting screw will be allowed.
- B. The housing dimensions shall be 1-1/2" deep and 15/16" wide. The seals are constructed of tubular, solid neoprene. Install with neoprene touching door and compressed 1/32". Solid neoprene to be used inside the housing to prevent sound from "flanking" through the mechanism. The assembly must have a weight of at least 0.825 lbs/ft in order to ensure durability. Note: Fire rated gaskets usually require mounting to the stop of the door jamb. Because the gasket dimension adds to the stop dimension, a lever handle should be used. If using knob locks, a 3-1/4" backset lock should be supplied.
- C. The following are acceptable:
  - 1. #770 from Zero International, Inc., Bronx, NY 800-635-5335
  - 2. Products manufactured by Reese Enterprises, Inc., or National Guard Products which meet the above requirements may be submitted for approval.

## 2.7 MEETING STILES

- A. Meeting stile for double leaf doors are an adjustable and spring loaded mortised astragal type (surface applied for fire rated doors) with a neoprene seal at the door intersection. The seals should be continuous with no interference from door hardware such as closers, exit devices, etc. Install seals so they are compressed against each other by 1/16".

- B. The following are acceptable:
  - 1. #555/ #55 from Zero International, Inc., Bronx, NY 800-635-5335
  - 2. Products manufactured by Reese Enterprises, Inc., or National Guard Products which meet the above requirements may be submitted for approval.

## 2.8 RABBETED SADDLE

- A. Rabbeted type saddle on floor constructed of aluminum with built-in tadpole-type neoprene seal. Length not to exceed 3-3/4" with a minimum one inch flat horizontal portion. Total clearance above finish floor shall not exceed 1/2" in order to make the saddle compatible with handicap accessibility requirements.
- B. The following are acceptable:
  - 1. #564 (fire rated) from Zero International, Inc., Bronx, NY , 800-635-5335
  - 2. #S248N (fire rated) from Reese Enterprises Inc, Rosemount, MN, 800-328-0953
  - 3. #8135NS from National Guard Products, Memphis, TN 800-647-7874
  - 4. or approved equal.

## 2.9 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  - 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
  - 1. Fabricate door and transom panels with full-width, solid-lumber meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Cut and trim openings through doors in factory.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Louvers: Factory install louvers in prepared openings.

## 2.10 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  - 1. Finish faces, all four edges, edges of cutouts, and mortises.
- B. Finish doors at factory.
- C. Transparent and Semi-Transparent Finish:

1. Grade: Premium.
2. Finish: AWI catalyzed polyurethane system.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Filled finish.
5. Sheen: Satin.
6. Color: Selected by Architect from the full range of manufacturers options.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
  1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
  1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

#### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

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## **SECTION 08 31 13 - ACCESS DOORS AND FRAMES**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Access doors and frames for walls and ceilings.
- B. Related Sections include the following:
  - 1. Division 03 Section "Insulating Concrete Forms" for blocking out openings for access doors and frames in concrete.
  - 2. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
  - 3. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
  - 4. Division 09 Section "Acoustical Tile Ceilings" for suspended acoustical tile ceilings.
  - 5. Division 23 Section "Air Duct Accessories" for heating and air-conditioning duct access doors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. NFPA 252 or UL 10B for vertical access doors and frames.
  - 2. ASTM E 119 or UL 263 for horizontal access doors and frames.

- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

## 1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

## PART 2 - PRODUCTS

### 2.1 STAINLESS-STEEL MATERIALS

- A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.
  - 1. Finish: Directional Satin Finish, No. 4.

### 2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- 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. Acudor Products, Inc.
  - 2. Babcock-Davis; A Cierra Products Co.
  - 3. Bar-Co, Inc. Div.; Alfab, Inc.
  - 4. Cendrex Inc.
  - 5. Dur-Red Products.
  - 6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
  - 7. Jensen Industries.
  - 8. J. L. Industries, Inc.
  - 9. Karp Associates, Inc.
  - 10. Larsen's Manufacturing Company.
  - 11. MIFAB, Inc.
  - 12. Milcor Inc.
  - 13. Nystrom, Inc.
  - 14. Williams Bros. Corporation of America (The).
- B. Flush Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet.
  - 1. Locations: Wall and ceiling surfaces.
  - 2. Door: Minimum 0.060-inch- thick sheet metal, set flush with exposed face flange of frame.
  - 3. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
  - 4. Hinges: Continuous piano.
  - 5. Lock: Cylinder (provided by panel manufacturer).
- C. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet.
  - 1. Locations: Wall and ceiling surfaces.
  - 2. Fire-Resistance Rating: Not less than that of adjacent construction.



3. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
6. Hinges: Continuous piano.
7. Automatic Closer: Spring type.
8. Lock: Self-latching device with cylinder lock (provided by panel manufacturer).

## 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 attachment devices and fasteners of type required to secure access panels to types of supports indicated.
  1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
  2. Provide mounting holes in frames for attachment of units to metal framing.
  3. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
  1. For cylinder lock, furnish two keys per lock and key all locks alike.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

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## **SECTIONS 08 34 63 AND 08 56 63 – DETENTION DOORS AND FRAMES**

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This Section includes detention security hollow metal [bullet resistant] products as scheduled in the contract drawings and as specified herein.
- B. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.02 PRODUCTS PROVIDED UNDER THIS SECTION

- A. Detention security hollow metal doors with specified fire rating and/or bullet resistance rating as indicated in the door schedule. Doors shall be swinging type or sliding type and shall be provided in the types and sizes scheduled in the contract drawings and as specified herein.
- B. Detention security hollow metal frames with specified fire rating and/or bullet resistance rating as indicated in the door schedule. Frames shall be provided in the types and sizes scheduled in the contract drawings and as specified herein.
- C. Detention security hollow metal frame infill panels with specified security grade, fire rating and/or bullet resistance rating as indicated in the door schedule. Panels shall be provided in the types and sizes scheduled in the contract drawings and as specified herein.
  - 1. Indicate bullet resistant doors, frames and panels only if applicable to the job. If these are to be fire-rated doors, frames and panels, indicate the required rating. Also indicate the type of door operation required (swinging or sliding).

#### 1.03 RELATED SECTIONS

- A. Section 087163.....Detention Door Hardware
- B. Section 088853.....Security Glazing
- C. Section 033000.....Cast in Place Concrete
- D. Section 033543.....Polished Concrete Floor Finishing
- E. Section 034500.....Precast Architectural Concrete
- F. Section 042000.....Unit Masonry System
- G. Section 051200.....Structural Steel Framing
- H. Section 081113.....Hollow Metal Doors and Frames
- I. Section 081119.....Stainless Steel Doors and Frames
- J. Section 083473.....Metal Sound Control Door Assemblies
- K. Section 099123.....Interior Painting

#### 1.04 REFERENCES

- A. ASTM A 1008 / A 1008M-16, Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
- B. ASTM A 1011 / A 1011M-15, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

- C. ASTM A 653/A 653M-15e1, Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dipped Process, (Commercial Steel)
- D. ASTM A 666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
- E. ASTM C 143 / C 143M-15a, Standard Test Method for Slump of Hydraulic Cement Concrete
- F. ANSI A 250.10 – 2011, Standard Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
- G. ASTM F 1450-12a (~~2004~~), Standard Test Methods for Hollow Metal Swinging Door Assemblies for Detention and Correctional Facilities.
- H. ASTM F 1592-12, Standard Test Methods for Detention Hollow Metal Vision Systems
- I. ANSI / NAAMM HMMA 801-12, Glossary of Terms for Hollow Metal Doors and Frames
- J. NAAMM HMMA 803-08, Steel Tables
- K. NAAMM HMMA 820-08, Hollow Metal Frames
- L. HMMA-820 TN01-03, Grouting Hollow Metal Frames
- M. NAAMM HMMA 840-07, Installation and Storage of Hollow Metal Doors and Frames
- N. NAAMM HMMA 850-00, Fire-Rated Hollow Metal Doors and Frames, Second Edition
- O. ANSI / NAAMM HMMA 866-12, Guide Specifications for Stainless Steel Hollow Metal Doors and Frames
- P. ANSI / NFPA 80-2016, Fire Doors and Windows
- Q. ANSI / NFPA 105-2016, Recommended Practice for the Installation of Smoke Control Door Assemblies
- R. ANSI / NFPA 252-2017, Standard Methods of Fire Tests of Door Assemblies
- S. ANSI / NFPA 257-2017, Methods for Fire Test of Window Assemblies
- T. ANSI / UL 9-2009, Fire Test of Window Assemblies, 7<sup>th</sup> Edition
- U. ANSI / UL 10B-2008, Fire Test of Door Assemblies, 9<sup>th</sup> Edition
- V. ANSI / UL 10C-2016, Standard for Positive Pressure Fire Tests of Door Assemblies, 1st Edition
- W. UL 1784-2015, Air Leakage Tests of Door Assemblies, 3<sup>rd</sup> Edition.
- X. UL 752-05, 11<sup>th</sup> Edition, Bullet Resisting Equipment

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ASTM	American Society for Testing and Materials Also known as ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 Telephone: 610-832-9585      www.astm.org
ICBO	International Code Council – Los Angeles Office Formerly known as International Conference of Building Officials Uniform Building Code 5360 Workman Mill Road Whittier, California 90601-2298 Telephone: 592-692-4226      www.icbo.org
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Avenue Suite 1000 Chicago, IL 60603 Telephone: 312-332-0405      www.naamm.org
NFPA	National Fire Protection Association 1 Batterymarch Park P.O. Box 9101 Quincy, MA 02269 Telephone: 617-770-3000      www.nfpa.org
UL	Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, Illinois 60062 Telephone: 708-272-8800      www.ul.com

Note: The following standards are used only for “traditional” negative pressure fire test methods and should be deleted from the project specifications when positive pressure testing is required by the governing building code: NFPA-252 (1.04.R), NFPA-257 (1.04.S), UL-10B (1.04.U), CAN4-S104 (1.04X) and CAN4-S106 (1.04.Y).

Conversely, the following standards are used for positive pressure fire tests, and should be deleted from project specifications requiring negative pressure fire tests: UL-9 (1.04.N), UL-10C (1.04.Y), UBC 7-2 (1.04.Z) and UBC 7-4 (1.04.AA).

## 1.05 TESTING AND PERFORMANCE

Performance grades for each opening shall be as indicated on the contract documents. Performance test requirements for each opening shall be as indicated for individual grade number designations shown in the tables in ASTM F 1450 and ASTM F 1592. Test procedures shall be performed on door and frame designs as described in Sections A, B, C, D and E.

### A. Door Assembly Impact Test

1. Two 3 ft. x 7 ft. (914 mm x 2134 mm) doors of each Grade to be tested shall be constructed in accordance with Section 2.01, each with 100 square inch (645.2 cm<sup>2</sup>) vision panel, 4 in. x 25 in. (102 mm x 635 mm) clear opening positioned generally as shown in ASTM F 1450, Figure 1. Doors shall have a maximum weight for Grades 1 and 2 of 230 lbs and for grades 3 and 4 of

190 lbs. Two accompanying frames shall be constructed in accordance with Section 2.03. One door and frame assembly shall be equipped with hardware in accordance with ASTM F 1450, Paragraph 6.1.2.4. The other assembly shall be equipped with hardware in accordance with ASTM F 1450, Paragraph 6.1.2.5. Test doors and frames shall be installed and tested in accordance with ASTM F 1450, Section 6, "Specimen Preparation" and Section 7.2 "Door Assembly Impact Test." The test assemblies shall meet the acceptance criteria in Section 7.2 in order to qualify under Section 1.05 of this specification.

2. Two 3 ft. x 7 ft. (914 mm x 2134 mm) doors of each Grade to be tested shall be constructed in accordance with Section 2.01 of this specification, each with two vision lights centered horizontally and located generally as shown in ASTM F 1450, Figure 1. The top vision shall have a clear opening size of 19 in. x 28 in. (483 mm x 711 mm) with impact panel installed. The bottom vision shall have a clear opening size of 19 in. x 18 in. (483 mm x 457 mm) with impact panel installed. Doors shall have a maximum weight for Grades 1 and 2 of 230 lbs and for grades 3 and 4 of 190 lbs. Two accompanying frames shall be constructed in accordance with Section 2.03 of this specification. One door and frame assembly shall be equipped with hardware in accordance with ASTM F 1450, Paragraph 6.1.3.4. The other assembly shall be equipped with hardware in accordance with ASTM F 1450, Paragraph 6.1.3.5. Test doors and frames shall be installed and tested in accordance with ASTM F 1450, Section 6, "Specimen Preparation" and Section 7.2 "Door Assembly Impact Test." The test assemblies shall meet the acceptance criteria in Section 7.2 in order to qualify under Section 1.05 of this specification.

#### B. Detention Hollow Metal Vision System Impact Test In Accordance With ASTM F 1592

1. A four (4) equal light multi-light security hollow metal assembly, overall dimensions of 48 in. width x 48 in. height (1219 x 1219 mm), shall be constructed in accordance with this specification, Section 2.03, and shall be impact tested in accordance with ASTM F 1592, Sections 5, 6 and 7.2. The test assembly shall meet the acceptance criteria in Section 7.2 in order to qualify under Section 1.05 of this specification.
2. A single sidelight security hollow metal assembly, door dimensions 3 ft. x 7 ft. (914 mm x 2134 mm) and sidelight dimensions with clear opening size of 30 in. wide x 42 in. high +/- 1 in. (762 mm x 1066 mm +/- 25 mm), shall be constructed in accordance with Sections 2.01 and 2.03, and shall be impact tested in accordance with ASTM F 1592, Sections 5, 6 and 7.2. The test assembly shall meet the acceptance criteria in Section 7.2 in order to qualify under Section 1.05 of this specification.

#### C. Door Static Load Test

Two (2) doors of each Grade to be tested constructed identically to each of the test doors required for Section 1.05.A.1 "Door Assembly Impact Test," 3 ft. x 7 ft. (914 x 2134 mm), with 4 in. x 25 in. (102 mm x 635 mm) vision panel, and with hardware preparations, shall be tested in accordance with ASTM F 1450, Section 7.3, "Door Static Load Test." The test doors shall meet the acceptance criteria in Section 7.3 in order to qualify under Section 1.05 of this specification.

#### D. Door Rack Test

Two (2) doors constructed identically to each of the test doors required in Section 1.05.A, "Door Assembly Impact Test," 3 ft. x 7 ft. (914 mm x 2134 mm), with 4 in. x 25 in. (102 mm x 635 mm) vision panel, and with hardware preparations shall be tested in accordance with ASTM F 1450, Section 7.4, "Door Rack Test." The test doors shall meet the acceptance criteria in Section 7.4 in order to qualify under Section 1.05 of this specification.

One 12 gauge door, .093 in. (2.3 mm), with two large vision lights as shown in ASTM F1450, Figure 2, with an "edge cut" food pass/cuff port 5 in. (127 mm) x 14.25 in. (362 mm) located 36.5 from the bottom of the door to the center line of the opening as shown in ASTM F1450, Figure 3, shall be

constructed in accordance with Section 2.01 of this specification. The door shall be tested in accordance with ASTM F 1450, Section 7.4, "Door Rack Test". The test door shall meet the acceptance criteria in Section 7.4.4.11 in order to qualify under Section 1.05 of this specification.

E. Door Edge Crush Test

One (1) door constructed identically to any of the test doors required in Section 1.05.A, "Door Assembly Impact Test," with hardware preparations, shall be tested in accordance with ASTM F 1450, Section 7.7 "Door Edge Crush Test."

F. Bullet Resistance Test

1. Where specified for individual openings, bullet resistance shall be certified by the application of a laboratory bullet resistance rating label on the door covering the assembly opening indicating compliance with the testing procedure described in UL Standard 752, and consistent with ASTM F 1450, Section 6, "Specimen Preparation" and Section 7.1, "Bullet Penetration." The bullet resistance rating shall be Level 3.

The .44 Magnum is used in this specification because it is the most powerful commonly available handgun. According to prison officials, high powered rifles, if any are kept on the premises, would be securely locked in an armory. Handguns, however, could be obtained in a riot situation or can be concealed and smuggled into public or secure areas. For this reason it is recommended that all doors which are indicated on the door schedule to be bullet resistant be certified for the .44 Magnum.

G. Test Reports

The manufacturer shall provide test reports and documentation by an independent testing laboratory in accordance with the reporting requirements of ASTM F 1450 and ASTM F 1592 certifying compliance with ANSI/NAAMM/HMMA 863, Section 1.05., current within five (5) years.

H. Labeled Fire Rated Doors and Frames

1. Fire labeled doors, frames, transom frames and side light assemblies shall be provided for those openings requiring fire protection, temperature rise, or smoke and draft control ratings as determined and scheduled by the Architect. Such products shall be tested in accordance with [ANSI/NFPA-252 or ANSI/UL-10B] [ANSI/UL-10C or UBC 7-2; Part 1] [UL 1784 or UBC 7-2; Part 2 or ANSI/NFPA 105] and constructed as listed and/or classified by a recognized testing agency having a factory inspection service.
2. Window frames shall be provided for those openings requiring fire protection ratings as determined and scheduled by the Architect. Such frames shall be tested in accordance with [ANSI/NFPA 257 or ANSI/UL 9] [UBC 7-4] and constructed as listed for labeling by a recognized testing laboratory having a factory follow up inspection service.

Note: UL 10C provides for positive pressure testing to accommodate the requirements of some jurisdictions and should be included only for such jurisdictions.

UL 1784, and ANSI/NFPA 105 provide for smoke and draft control assembly testing to accommodate these specific requirements and should be included only when required.

3. If any door or frame specified by the Architect to be fire-rated cannot qualify for appropriate

labeling because of its design, hardware, or any other reason, the Architect shall be so advised in the submittal documents or prior to manufacture of the product.

Note: Refer to NAAMM/HMMA 850, "Fire-Rated Hollow Metal Doors and Frames," for additional information.

## 1.06 QUALITY ASSURANCE

### A. Acceptable Manufacturers

1. Trussbilt, LLC – Vadnais Heights, MN  
Telephone: 651.633.6100                      Fax: 651.628.9482  
Website: [www.trussbilt.com](http://www.trussbilt.com)
2. American Steel Products  
Telephone: 706-413-3816  
Website: [www.amsteelpro.com](http://www.amsteelpro.com)
3. Other manufacturers must submit their qualifications, test reports and product deviations to the architect ten (10) days prior to the bid for approval. Test reports must include name and address of laboratory, date laboratory completed the tests, name and address of manufacturer, description of identifying markings on all components of test assembly, location of testing equipment, diagrams, details and photographs of testing equipment, specifications and details of components of test assembly drawings, door and frame component drawings, hardware templates and instructions, wall specifications, and details of anchoring devices, and all test data and load deflection graphs.

Note: Being listed as an acceptable manufacturer is not the acceptance of the manufacturer's standard product. Acceptance is only approval to bid the project per the plans and specifications.

### B. Manufacturer's Qualification

1. Manufacturer shall provide evidence of having personnel and plant equipment capable of fabricating hollow metal door and frame assemblies of the type specified herein. Manufacturer shall provide current documentation of the number of employees, a listing of their production equipment, and a description of their manufacturing facility.

Manufacturers shall be ISO 9001:2008 certified and shall be required to present their Certificate of Registration upon request. The manufacturer's registrar shall be nationally recognized and shall provide the manufacturer with periodic factory follow up audits reaffirming the manufacturer's continuing compliance with their written quality program.

2. Manufacturer's production welders shall be qualified under AWS D1.3 and upon request shall provide copies of Welders Certifications in accordance with AWS D1.3.
3. Manufacturers shall have a minimum of ten (10) years experience successfully producing detention hollow metal of the types and sizes required in the contract documents. Upon request the manufacturer shall provide a list of successfully completed projects and the dates they were completed.
4. Manufacturers shall have written test reports of their having passed the testing requirements of section 1.05 and using their current materials and production processes.

### C. Samples

1. Door: 1'-0" x 1'-0" (305 mm x 305 mm) corner section with hinge mortise and reinforcement



showing internal construction.

2. Frame: 1'-0" x 1'-0" (305 mm x 305 mm) corner section showing welding of head to jamb. Include hinge mortise, reinforcement and plaster guard in one rabbet, and glazing stop applied as specified in the opposite rabbet. Glazing stop shall be applied in both head and jamb section to show corner joint.
3. All samples submitted shall be of the production type and shall represent in all respects the minimum quality of work to be furnished by the manufacturer. No work represented by the samples shall be fabricated until the samples are approved, and any downgrading of quality demonstrated by the samples can be cause for rejection of the work.

#### D. Quality Criteria

1. Provide fabricated systems that are identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7. Based on NOA 11-0517.12 & 11-0517.14
  - a. Ultimate Design Wind Speed to be 145 mph, Exposure C, Risk Category IV.
2. All door and frame construction shall be in accordance with construction of assemblies, which meet the testing requirements of Section 1.05.
3. Fire labeled doors and frames shall be provided for those openings indicated in the schedule as requiring fire protection ratings. Such doors and frames shall be constructed as tested in accordance with ASTM E 152, UL-10B or NFPA-252 and labeled by a recognized testing agency having a factory inspection service.
3. If any door or frame specified by the Architect to be fire-rated cannot qualify for appropriate labeling because of its design, hardware or any other reason, the Architect shall be so advised before fabricating work on that item is started.
4. Fabrication methods and product quality shall meet standards set by the Hollow Metal Manufacturers Association, HMMA, a Division of the National Association of Architectural Metal Manufacturers, NAAMM, as set forth in these specifications.
5. Job Site Door Check  
At the owner's option, a door at the job site shall be selected at random and sawed in half or otherwise taken apart as deemed necessary for verification that construction is in accordance with these specifications. If the door construction does not conform to these specifications the non-conforming doors shall be repaired or replaced at the manufacturer's expense. If the door construction complies with the specification a replacement door must be ordered and added to the project, not at the cost of the manufacturer.

### 1.07 SUBMITTALS

#### A. Submittal Drawings

1. Show door and frame elevations and sections.
2. Show listing of opening descriptions including locations, material thicknesses, and anchors.
3. Show location and details of all openings.

### 1.09 WARRANTY

All hollow metal work shall be warranted from defects in workmanship and quality for a period of one (1) year from the date of substantial completion of the project.

## PART 2 - PRODUCTS

### 2.01 DETENTION SECURITY HOLLOW METAL DOORS

#### A. Materials

1. Doors shall be manufactured of commercial quality, level, hot-rolled, pickled and dry steel conforming to ASTM A 1011 / A 1011M CS type B. The steel shall be free of scale, pitting, coil breaks, buckles, waves or other surface blemishes or defects.
2. Interior doors: Face sheets shall be [for Grades 3 and 4: 0.067 in. (1.7 mm)] [for Grades 1 and 2: 0.093 in. (2.3 mm)] minimum thickness.

Note: For interior doors subject to corrosive conditions, it is recommended that zinc coated steel face sheets, as specified in 2.01.A.3, be used.

3. Exterior Doors: Face sheets shall be [for Grades 3 and 4: 0.067 in. (1.7 mm)] [for Grades 1 and 2: 0.093 in. (2.3 mm)] minimum thickness and shall have a zinc coating applied by the hot-dip process conforming to ASTM A 653/A 653M Commercial Steel (CS type B), coating designation A60 (ZF180).

Note: If the Architect determines that zinc coated components for zinc coated face sheets are needed in addition to galvanized face sheets, 2.01.A.3 is the appropriate location to specify that requirement.

4. For severely corrosive conditions and where specified for individual openings, either interior or exterior: Face sheets shall be [0.067 in. (1.7 mm)] [0.093 in. (2.3 mm)] minimum thickness. Face sheets and components shall be stainless steel conforming to ASTM A 666, Type [304] [316]. Steel stiffened construction methods and finishes for stainless steel doors shall comply with ANSI/NAAMM/HMMA 866.

#### B. Construction:

1. All doors shall be of the types and sizes shown on the approved submittal drawings, shall be constructed in accordance with the specifications and shall meet the performance requirements of Paragraph 1.05 where applicable. Alternate materials and methods of construction, which meet the aforementioned performance criteria, shall be permitted.
2. Door face sheets shall be joined at their vertical edges by a continuous weld extending the full height of the door. This edge seam weld shall be sanded smooth and be neat in appearance. The door vertical edges shall not be covered with auto body putty or metallic fillers. The weld shall be visible to ensure a continuous weld.
3. Door thickness shall be 2 in. (50 mm) nominal to accommodate detention hardware. Doors shall be neat in appearance and free from warpage or buckle. Edge bends shall be true and straight and of minimum radius for the thickness of material used.
4. The door shall be stiffened by one of the following systems:
  - a. Continuous steel truss design core material, .015 in. (.4 mm) minimum, having truncated triangular roll formed sections extending continuously from one door face to the other, spot

welded to each face sheet 2 ¾ in. (69.9 mm) oc horizontally and 3 in. (76.2 mm) oc vertically. Core material shall extend full height and width of door.

- b. Continuous vertical hat sections, one such hat section welded to each face of the door, .053 in. (1.3 mm), with vertical webs no more than 4 in. (101.6 mm) apart. Hat sections shall be welded to each other at 6 in. (152.4 mm) O.C. both sides in order to prevent separation.

Spaces between stiffeners shall be filled with fiberglass or mineral rockwool batt-type material, minimum 6 lb. density.

5. The vertical edges shall be reinforced by a continuous steel channel extending the full height of the door and welded to both face sheets. The channels' thickness shall be not less than the thickness of the door face sheet. The top and bottom edges shall be closed with a continuous channel, the same thickness as the vertical edge channels and shall be spot-welded to the face sheet a maximum of 3 in. (76 mm) O.C. The closing end channel shall be continuously welded to the vertical reinforcing channel at all four corners producing a fully welded perimeter reinforcing channel.
6. The top and bottom end channel shall be fitted with an additional flush closing channel of the same material thickness. The flush closing channel shall be welded in place at the corners and at the center. Tops of exterior doors shall be made weather tight where specified.
7. Edge profiles shall be provided on both vertical edges of doors as follows:
- Single acting doors - beveled 1/8 in. (3 mm) in 2 in. (50 mm) profile
  - Sliding doors or equivalent - square profile
8. Hardware reinforcements:
- a. Doors shall be mortised, reinforced, drilled and tapped at the factory for completely templated mortised hardware only, in accordance with the final approved hardware schedule and templates provided by the hardware supplier. Where surface mounted hardware - or non-templated mortised hardware - is to be applied, doors shall be reinforced, and all drilling and tapping shall be done by others in the field.
- b. Minimum thicknesses for hardware reinforcements shall be as follows:
- Full mortise hinges and pivots 0.167 in. (4.2 mm)
  - Surface applied maximum security hinges 0.214 in. (5.4 mm)
  - Strikes (reinforcing tabs) 0.167 in. (4.2 mm)
  - Strikes (channel reinforcement) 0.125 in. (3.17 mm)
  - Slide device hanger attachment - per device manufacturer's recommendations
  - Lock fronts, concealed holders, or surface mounted closer 0.093 in. (2.3 mm)
  - All other surface applied hardware 0.093 in. (2.3 mm)
- c. In cases where electrically operated hardware is required, and where shown on approved submittal drawings, hardware enclosures and junction boxes shall be provided and shall be interconnected using UL approved 0.75" (19 mm) minimum diameter conduit and

connectors. Also, where shown on submittal drawings, junction boxes with access plates shall be provided to facilitate the proper installation of wiring. Access plates shall be the same thickness as the face sheet and fastened with a minimum of four (4) #8-32 tamper resistant machine screws, not to exceed 6 in. (152 mm) O.C.

9. Glass moldings and stops:

- a. Where specified, doors shall be provided with steel moldings to secure glazing by others in accordance with glass sizes and thicknesses shown on approved submittal drawings.
- b. Fixed glass molding shall be not less than 0.093 in. (2.3 mm) and shall be spot-welded to both face sheets 3.0 in. (76 mm) O.C. maximum.
- c. In glass openings where security glazing is specified and where shown on the approved submittal drawings, pressed steel angle glazing stops (or "Z" or plate type stops depending on glass thickness), no less than 0.093 in. (2.3 mm) thickness, shall be provided. Angle stops shall be mitered or notched and tight fitting at the corner joints and secured in place using 1/4 - 20 or 1/4 - 28 button head tamper resistant screws with spacing necessary to satisfy the performance criteria outlined in Section 1.05.

Note: It is recommended that view window stop heights be specified to provide 1 in. (25.4 mm) glass engagement.

Advisory: It is not advisable to locate glass preparations in close proximity to hardware preparations at the door edge, since it can be detrimental to door stiffness.

- d. Metal surfaces to which glazing stops are secured, and the inside of the glazing stops shall be treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation in the door, or shall be fabricated from A60 (ZF180) zinc coated steel per 2.01.A.3.
10. Louvers shall be of the welded inverted "Y" type construction providing free air delivery as specified. The louver opening shall be a flush opening fabricated using interior channels 0.093 in. (2.3 mm) minimum thickness, securely welded to the inside of both face sheets. The vanes shall be not less than 0.093 in. (2.3 mm) thickness and shall be spaced so that no rigid flat instrument can be passed through them. Louvers of other designs, which meet the security requirements, can be qualified for this application.
11. Speaking devices shall consist of a rectangular pattern of round holes, no more than 0.25 in. (6.4 mm) dia., in both face sheets directly across from each other. The minimum size of the rectangular hole pattern shall be 1 in. (25 mm) high x 4 in. (102 mm) wide with holes spaced no more than 1 in. (25 mm) o.c. vertically and horizontally. The interior of the door between the rectangular hole patterns shall be baffled using pressed steel sections, not less than 0.042 in. (1.0 mm), so that no objects can be passed through.
12. Food pass/cuff port openings:
- a. The food pass opening shall be fabricated using interior Zee shaped formed sections 0.093 in. (2.3 mm) minimum thickness, securely welded to the inside of both face sheets. The four corner seams shall be continuously arc welded internally. The finished opening shall be of such construction that it cannot be dismantled or otherwise affected by tampering or scraping.
  - b. The food pass shutter door shall be constructed from 0.067 in. (3.1 mm) thickness steel, press formed, hollow metal flush assembly with a 0.167 (4.2mm) backup plate on the inmate side.

- c. The shutters shall be treated for maximum paint adhesion and given a shop coat of rust inhibitive primer. Shutters and food pass hardware shall be factory installed.

13. Product Identification: Doors shall have the Architect's mark number permanently stamped on the center hinge reinforcement for swing doors and on the horizontal Z of the window for sliding door types.

## 2.02 HOLLOW METAL INFILL PANELS

- A. Hollow metal infill panels shall be made of the same materials and construction and finished in the same way as specified in Section 2.01 of this specification.

## 2.03 HOLLOW METAL FRAMES

### A. Materials

1. Frames shall be constructed of commercial quality, hot rolled, pickled dry steel conforming to A1011/A1011M. The steel shall be free of scale, pitting, coil breaks or other surface defects.
2. Interior openings: Steel shall be [for Grades 3 and 4, 0.067 in. (1.7 mm)] [for Grades 1 and 2, 0.093 in. (2.3 mm)] minimum thickness.

Note: For interior areas subject to corrosive conditions, it is recommended that zinc coated frames as specified in 2.03 A.3 be used.

3. Exterior openings: Steel shall be [for Grades 3 and 4, 0.067 in. (1.7 mm)] [for Grades 1 and 2, 0.093 in. (2.3 mm)] minimum thickness and shall have a zinc coating applied by the hot-dip process conforming to ASTM A 653/A 653M Commercial Steel (CS), coating designation A60 (Z180).

### B. Construction:

1. All frames, with the exception of cased openings such as for sliding doors, shall have integral stops and be welded units of the sizes and types shown on approved submittal drawings. Frames shall be constructed in accordance with these specifications and meet performance criteria specified in Section 1.05 where applicable. Alternate materials and methods of construction, which meet the aforementioned performance criteria, shall be permitted.
2. All finished work shall be neat in appearance, square, and free of defects, warps and buckles. Pressed steel members shall be straight and of uniform profile throughout their lengths.
3. Jamb, header and sill profiles shall be in accordance with the frame schedule and as shown on the approved submittal drawings.
4. Corner joints shall have all contact edges closed tight with faces mitered and stops either butted or mitered. Corner joints shall be continuously welded and the use of gussets or splice plates shall be unacceptable.
5. Minimum height of stops in door openings shall be 0.75 in. (19 mm). Height of stops on security glass or panel openings shall be as shown on approved submittal drawings.
6. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designated for splicing in the field by others. Where splicing is necessary, angle splices shall be installed at the corners of the profile, and shall extend at least 1 in. (25.4 mm) on either side of the joint. Splicing angles shall be the same gage thickness as the frame. Field splices

shall be made in accordance with approved submittal drawings.

7. Frames for multiple openings shall have mullion members which, after fabrication, are closed tubular shapes conforming to profiles shown on approved submittal drawings. All exposed joints between faces of abutted members shall be continuously welded and finished smooth. All exposed joints between stops of abutted members shall be welded along the soffit and shall be left neat and uniform in appearance. At mullions, longitudinal joint may occur creating a seam. Where possible, conceal this seam behind a glazing stop. The contractor responsible for installation shall provide for welding and finishing all field joints between faces of abutted members.
8. Hardware Reinforcements and Preparation:
  - a. Frames shall be mortised, reinforced, drilled and tapped for all templated mortised hardware only, in accordance with the final approved hardware schedule and templates provided by the hardware supplier. Where surface mounted hardware - anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated mortised hardware - is to be applied, frames shall be reinforced, and all drilling and tapping shall be done by others in the field.
  - b. Minimum thickness of hardware reinforcing plates shall be as follows:
    - Hinges and pivots 0.167 in. x 1.5 in. x 10 in. length  
(4.2 mm x 38 mm x 254 mm)
    - Strikes 0.167 in. (4.2 mm)
    - Closers (concealed) 0.167 in. (4.2 mm)
    - Flush bolts 0.167 in. (4.2 mm)
    - All other surface applied hardware - 0.093 in. (2.3 mm)
  - c. In cases where electrically operated hardware is required, and where shown on contract drawings, hardware enclosures and junction boxes shall be provided, and shall be interconnected using UL approved 0.75 in. (19 mm) diameter minimum conduit and connectors. Also, where shown on submittal drawings, junction boxes with access plates shall be provided to facilitate the proper installation of wiring. Access plates shall be the same thickness as the frame and fastened with a minimum of four (4) #8-32 tamper resistant machine screws, not to exceed 6 in. (152 mm) o.c.
9. Floor Anchors:
  - a. Floor anchors with two holes for fasteners shall be fastened inside jambs with at least four (4) spot welds, per anchor or MIG welded on both sides.
  - b. Where so scheduled, adjustable floor anchors, providing not less than 2 in. (50 mm) height adjustment, shall be fastened in place with at least four (4) spot-welds per anchor or MIG welded on both sides.
  - c. Thickness of floor anchors shall be the same as frame.
10. Jamb Anchors:
  - a. Anchor Spacing

The number of anchors provided on each jamb shall be as follows:

Borrowed lite frames	2 anchors plus 1 for each 24 in. (406 mm) or fraction thereof over 36 in. (914 mm), spaced at 24 in. (406 mm) maximum between anchors
Door frames	2 anchors plus 1 for each 24 in. (406 mm) or fraction thereof over 54 in. (1372 mm), spaced at 24 in. (406 mm) maximum between anchors (fire ratings can require additional anchors)

b. Masonry Type

Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the strap and stirrup type made from the same thickness steel as frame. Straps shall be 2 in. x 10 in. (50 mm x 254 mm) in size, corrugated and perforated.

c. Embedment Masonry Type

1. Frames for installation in prefinished masonry or concrete openings shall be provided with removable faces at the jambs, and 0.167 in. x 2 in. x 2 in. (4.2 mm x 50 mm x 50 mm) angle anchors 4 in. (102 mm) long spaced as described in Paragraph 2.03.B.10.a. The frame anchors shall be located to coincide with matching embedded anchors to be provided for installation in the wall.
2. Embedded wall anchors shall consist of a 0.167 in. (4.2 mm) x 4 in. (102 mm) wide x 6 in. (152 mm) plate with 0.167 in. x 2 in. x 2 in. (4.2 mm x 50 mm x 50 mm) angle anchors 4 in. (102 mm) long welded in place at locations to match angle anchors in frames. The embedded plate shall be provided with two (2) #4 re-bar wall anchors 10 in. (254 mm) long minimum, with 2 in. (51 mm) x 90 degree turn down on ends continuously welded in place, and spaced as described in Paragraph 2.03.B.10a. Embedments shall be prime painted in accordance with Paragraph 2.03.B.14.
3. Angle anchors shall each be fastened to jamb and to embedded plate with two (2) 1 in. (2.5 mm) long arc welds at each end of the anchor. Anchors shall be shipped loose.
4. The complete anchorage system shall provide that the jamb faces be removed from the frames in the field by the contractor responsible for installation, and the frames be moved into the opening until the frame anchors contact and match the embedded anchors. The contractor responsible for installation shall field weld all anchors and install the jamb faces in place. Embedment anchoring details shall be provided on approved submittal drawings.

d. Expansion Bolt Type

1. Frames for installation in existing masonry or concrete walls shall be prepared for expansion bolt type anchors. The preparation shall consist of a punch and dimpled hole for a 0.5 in. (13 mm) diameter bolt and a .093 in. (2.3 mm) spacer from the unexposed surface of the frame to the wall. The spacer shall be welded to the frame and the preparation spaced as described in Paragraph 2.03.B.10.a.
2. After sufficient tightening of the bolt, the bolt head shall be welded by the installation contractor so as to provide a non-removable condition. The welded bolt head shall be ground, dressed and finished smooth.

- e. Frames to be installed in pre-finished concrete, masonry or steel openings shall be constructed and provided with anchoring systems of suitable design as shown on the approved submittal drawings.

11. Grout guards shall be provided at all hardware preparations, glazing stop screws and silencer preparations on frames to be set in masonry or concrete openings. Grout guards shall be sufficient to protect preparations from grout of a 4 in. (102 mm) maximum slump consistency which is hand troweled in place. All hinge grout guards and lock pockets shall be caulked after priming to ensure maximum protection from grout seepage.
  - a. Grout guards for glazing stop screws shall be factory installed and shall cover the exposed portion of the screws inside the frame throat, around the perimeter. Where mullions are required to be grouted, screws inside mullions shall be protected with grout guards.
  - b. Steel grout guards shall protect silencer preparations where accessible from the frame throat. Silencers shall be furnished and installed by the contractor responsible for frame installation except where limited access prevents installation of the metal grout guards in mullions, in which case silencers shall be factory furnished and installed.
12. All frames shall be provided with two (2) temporary steel spreaders welded to the bottom of the jambs to serve as bracing during shipping and handling. The installation contractor shall be responsible for removing, finishing, and touch-up of marks caused by spreader removal.
13. Removable glazing stops:
  - a. In openings where security glazing is specified and where shown on the approved submittal drawings, pressed steel angle glazing stops, not less than 0.093 in. (2.3 mm), shall be provided. Angle stops shall be mitered or notched and tight fitting at the corner joints, and secured in place using 1/4 - 20 or 1/4 - 28 button head tamper resistant screws with spacing necessary to satisfy the performance criteria outlined in Section 1.05.

Note: It is recommended that view window stop heights be specified to provide 1 in. (25.4 mm) glass engagement.
  - b. The frame underneath the glazing stops and the inside of the glazing stops shall be treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation in the frame.

## 2.04 MANUFACTURING TOLERANCES

Note: The manufacturer of the doors and frames is responsible only for the manufacturing tolerances listed in Section 2.04. The final clearances and relationships between door and frame depends on the setting of the frame and the hanging and adjustment of the door and hardware. (See Sections 3.02 and 3.03.)

- A. Manufacturing tolerance shall be maintained within the following limits:
  1. Frames for single doors or pairs of doors:
    - a. Width, measured between rabbets at the head: Nominal opening width + 1/16 in. (1.6 mm), - 1/32 in. (0.8 mm).
    - b. Height (total length of jamb rabbet): Nominal opening height +/- 3/64 in. (1.2 mm).
  2. Cross sectional profile dimensions (see Figure 1):



- a. Face □□□ 1/32 in. (0.8 mm)
- b. Stop □□□□ 1/32 in. (0.8 mm)
- c. Rabbet □□□□ 1/32 in. (0.8 mm)
- d. Depth □□□ 1/32 in. (0.8 mm)
- e. Throat □□□ 1/16 in. (1.6 mm)

Note: Frames overlapping walls to have throat dimension 1/8 in. (3.1 mm) greater than wall thickness to accommodate irregularities in wall construction.

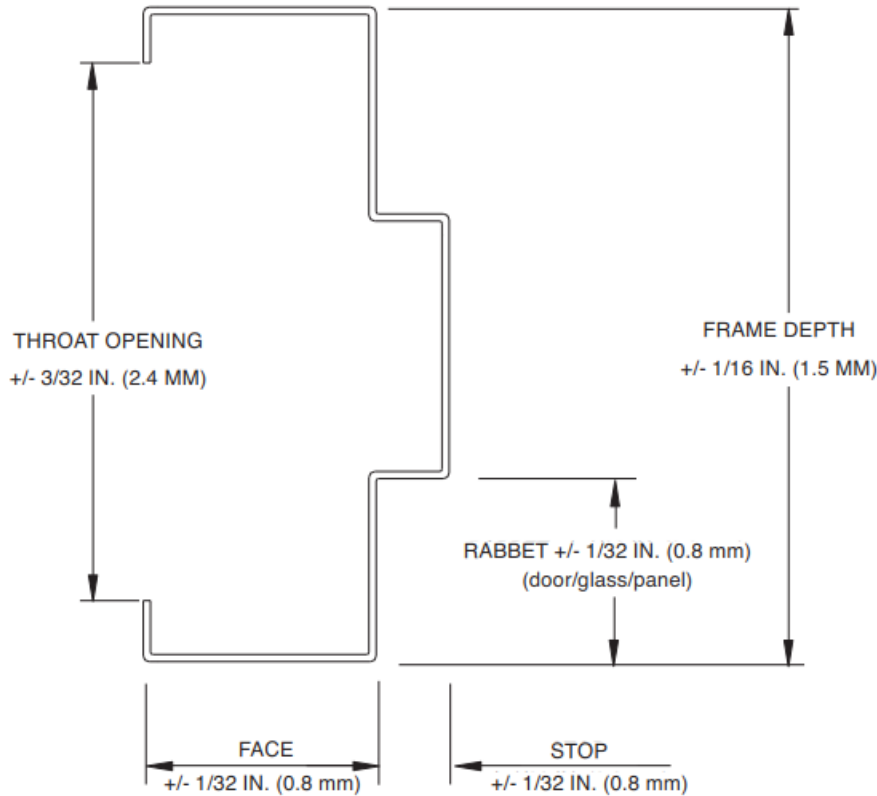


Figure 1

- 3. Flatness of large frames 1/8 in. (3.1 mm) in 10 ft. (3048 mm) of length or width
- 4. Doors – Doors are undersized to fit the frame. Edge clearances are based upon individual door manufacturer’s designs. Tolerance on actual door sizes are as follows:
  - a. Width □□□ 3/64 in. (1.2 mm)
  - b. Height □□□ 3/64 in. (1.2 mm)
  - c. Thickness □□□ 1/16 in. (1.5 mm)
  - d. Bow/flatness □□□ 1/8 in. (3.2 mm) in 7 ft. (2134 mm)
- 5. Hardware
  - a. Cutout and template dimensions □□□ 0.015 in. (0.38 mm) - 0 in.
  - b. Location □□□ 1/32 in. (0.8 mm)
  - c. Between hinge centerlines +/- 1/64 in. (0.4 mm)

2.05 HARDWARE LOCATIONS

The location of hardware on doors and frames shall be as listed below. Note that all dimensions except the hinge locations are referenced from the finished floor as defined in Section 3.03.

A. Hinges:

Top 5 in. (127.0 mm) from frame head to top of hinge

Bottom 10 in. (254 mm) from floor to bottom of hinge

Intermediate centered between top and bottom hinges

B. Locks and latches 38 in. (965 mm) to centerline of knob or lever shaft

C. Deadlocks 37 in. (940 mm) to centerline of bolt

D. Exit hardware 38 in. (965 mm) to centerline of cross bar or as shown on hardware template

E. Door pulls 47 in. (1194 mm) to centerline of grip

F. Push plates 47 in. (1194 mm) to centerline of plate

G. Intercoms 48 in. (1219 mm) to centerline of intercom / backbox

Note: All dimensions are subject to change depending on hardware items having to move to avoid interference

2.06 FINISH

After fabrication, all tool marks and surface imperfections shall be filled and sanded as required to make face sheets, vertical edges and weld joints free from irregularities. After appropriate metal preparation, all exposed surfaces of doors and frames shall receive a rust inhibitive primer which meets or exceeds ANSI A 250.10, "Test Procedures and Acceptance Criteria for Prime Painting Steel Surfaces for Steel Doors and Frames." For stainless steel finishes refer to ANSI/NAAMM/HMMA-866.

Note: All primer and finish paint must be formulated for Direct to Metal (DTM) application.

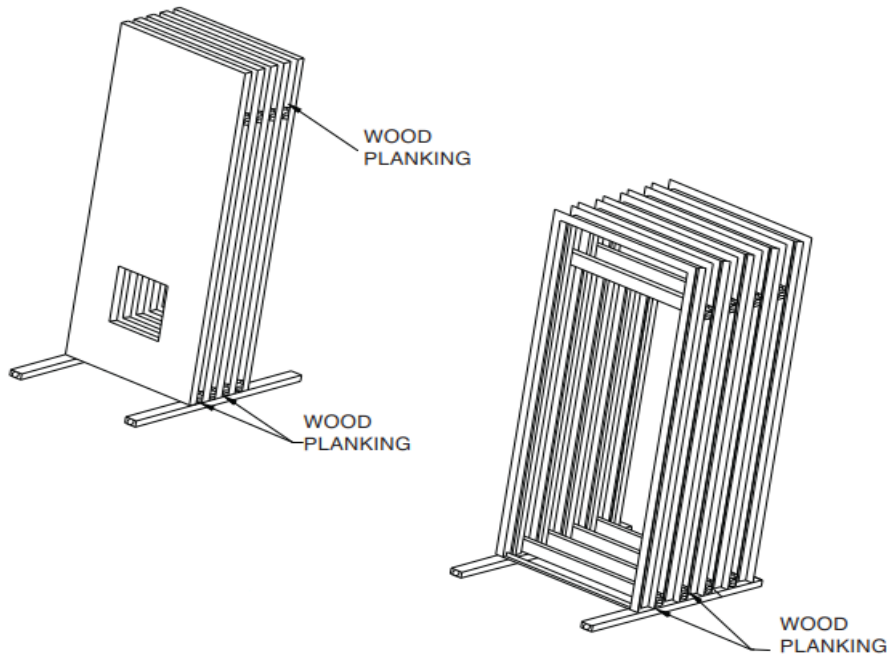
**PART 3 - EXECUTION**

Note to Contractor: Proper storage and protection is essential to the proper performance of doors and frames. The requirements for proper storage are given in the following sections. However, it is important to recognize that proper storage is not the responsibility of the hollow metal manufacturer. For this reason, the requirements for storage and protection of detention hollow metal doors and frames shall be referenced in that section of the specifications where installation of work is specified. (Reference: HMMA 840 "Installation and Storage of Hollow Metal Doors and Frames".)

3.01 SITE STORAGE AND PROTECTION OF MATERIALS

A. The contractor responsible for installation shall remove wraps or covers from doors and frames upon delivery at the building site. The contractor responsible for installation shall ensure that any scratches or disfigurement caused in shipping or handling are promptly sanded smooth, cleaned and touched up with a compatible rust inhibitive Direct to Metal (DTM) primer.

B. The contractor responsible for installation shall ensure that materials are properly stored on planks or dunnage in a dry location. Doors and frames shall be stored in a vertical position and spaced by blocking. Figure 2 illustrates recommended storage positioning. Materials shall be covered to protect them from damage but in such a manner as to permit air circulation.



**Figure 2**

**3.02 INSTALLATION**

Note to Contractor: Correct installation is essential to the proper performance of detention doors and frames. The requirements for proper installation are given in the following sections. However, it is important to recognize that installation is not the responsibility of the detention hollow metal manufacturer. For this reason, the requirements for installation of detention hollow metal doors and frames shall be referenced in that section of the specifications where installation of work is specified. It is the responsibility of the general contractor using experienced personnel to perform the work outlined in this section. (Reference: HMMA 840 "Installation and Storage of Hollow Metal Doors and Frames.")

The Contractor responsible for installation shall perform the following:

- A. Prior to installation, all frames shall be checked for correct size and swing, and with temporary spreaders removed be corrected for squareness, alignment, twist and plumb. Permissible installation tolerances shall not exceed 1/16 in. (1.5 mm):

Squareness:	Measured at rabbet on a line from jamb, perpendicular to frame head.
Alignment:	Measured at jambs on a horizontal line parallel to the plane of the face.
Twist:	Measured at opposite face corners of jambs on parallel lines, perpendicular to the plane of the door rabbet.
Plumbness:	Measured at jambs on a perpendicular line from the head to the floor.

During the setting of the frames, check and maintain these tolerances for squareness, alignment, twist and plumbness.

The details in Figure 3 illustrate methods of measuring the above specified tolerances.

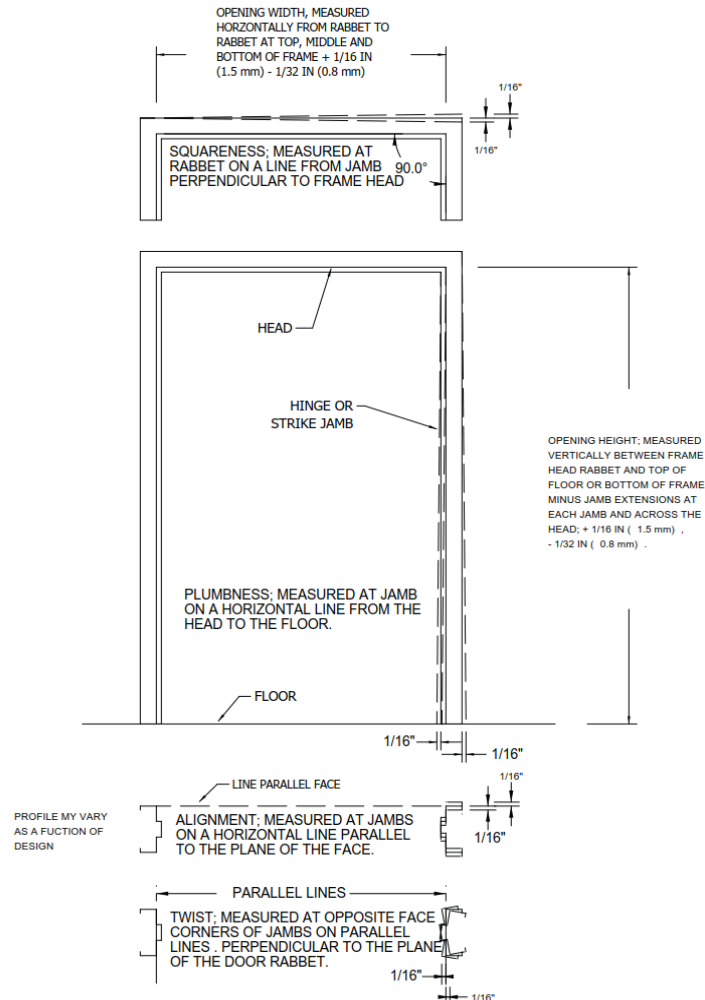


Figure 3  
 Installation Tolerances

Note: The tolerances above provide a reasonable guideline for proper installation of hollow metal frames. However, it should be noted that the cumulative effect of the installation tolerances at or near their maximum levels could result in sufficient misalignment which prevents the door from functioning properly. Installers should be careful not to create an installation tolerance buildup. Tolerance buildup occurs when several dimensions are at or near their maximum tolerance.

- B. Frame jambs shall be fully grouted to provide added security protection against battering, wedging, spreading and other means of forcing open the door. Jamb mounted lock preparations, grout guards for hardware preparations and glazing stop screws, and junction boxes are intended to protect hardware mortises, exposed removable screws, and tapped mounting holes from masonry grout of 4 in. (102 mm) maximum slump consistency which is hand troweled in place. If a light consistency grout (greater than 4 in. (102 mm) slump in accordance with ASTM C 143 / C 143M) is to be used, special precautions shall be taken in the field by the installation contractor to protect tapped holes, electrical knock-outs, lock pockets, grout guards, junction boxes, etc. in the frames.

Large frame sections, such as lock columns and lock jambs, are not intended or designed to act as forms for grout or concrete. Grouting of large hollow metal sections shall be done in "lifts" or

precautions shall otherwise be taken by the contractor to ensure that frames are not deformed or damaged by the hydraulic forces that occur during this process.

Note: The drawbacks and benefits associated with the use of water-based masonry grouts, with or without antifreeze agents, should be carefully weighed during the detailing and specification process. Plaster-based grouts should not be used under any circumstances. Please refer to NAAMM's HMMA Technical Note, HMMA-820 TN01-03, "Grouting Hollow Metal Frames," for further guidance.

- C. Proper door clearances shall be maintained in accordance with 3.03 of these specifications, except for special conditions otherwise noted. Where necessary, metal hinge shims, furnished by the Contractor responsible for installation, are acceptable to maintain clearances.
- D. Hardware shall be applied in accordance with hardware manufacturer's templates and instructions.
- E. Any grout or other bonding material shall be cleaned off of frames or doors immediately following installation. Exposed hollow metal surfaces shall be kept free of grout, tar, or other bonding material or sealer.
- F. Exposed field welds shall be finished smooth and touched up with a rust inhibitive primer.
- G. Primed or painted surfaces which have been scratched or otherwise marred during installation, cleaning, and/or field welding, including marks caused by spreader removal, shall promptly be finished smooth, cleaned, treated for maximum paint adhesion and touched up with a rust inhibitive Direct to Metal (DTM) primer comparable to and compatible with the shop applied primer and finish paint specified in Section 099000. All touch-up primer and finish paint must be formulated for DTM application.
- H. Finish paint in accordance with Section 099000.
- I. Install door silencers.
- J. Install glazing materials in accordance with Section 088000.

### 3.03 CLEARANCES

- A. Edge clearances for swinging doors shall provide for the functional operation of the assembly and shall not exceed the following:
  - 1. Between doors and frames at head and jambs: 3/16 in. (4.7 mm)
  - 2. Between edges of pairs of doors: 3/16 in. (4.7 mm)
  - 3. At doorsills where a threshold is used: 3/8 in. (9.5 mm)
  - 4. At doorsills where no threshold is used: 3/4 in. (19.1 mm)
  - 5. Between door bottom and nominal surface of floor coverings at fire rated openings as provided in ANSI/NFPA 80, 1/4 in. (12.7 mm).
- B. Clearances for detention sliding doors shall be in accordance with the approved slider device drawings furnished as part of the approved hardware schedule.

Note: Floor is defined as the top of the concrete slab or structural floor. Where resilient tile, hardwood or other floor coverings are used, undercuts must be increased in order to accommodate those floor coverings. The Architect must define the distance from the top of the

floor/finished floor to the top of the floor covering so that appropriate undercuts can be provided. Refer to NAAMM's HMMA-810 TN01-03 "Defining Undercuts".

The final clearances and relationship between door and frame depend upon the setting of the frame and the hanging and adjusting of the door and hardware. If everything is perfect in the setting of the frame, and the manufacturing of the doors and frames, the clearances should be as shown in 3.03. However, if the frame is set to its maximum allowable tolerances, and the doors and frames are manufactured to their maximum allowable tolerances, the clearances could be greater.

All clearances are subject to change depending upon the requirements of the specified hardware.

END OF SECTIONS 08 34 63 AND 08 56 63

## SECTION 087100

### DOOR HARDWARE

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Hardware for hollow metal doors.
- B. Electrically operated and controlled hardware.
- C. Lock cylinders for doors with balance of hardware specified in other sections.
- D. Thresholds.
- E. Weatherstripping and gasketing.

##### 1.02 RELATED REQUIREMENTS

- A. Section 062000 - Finish Carpentry: Wood door frames.
- B. Section 080671 - Door Hardware Schedule: Schedule of door hardware sets.
- C. Section 081113 - Hollow Metal Doors and Frames.
- D. Section 081213 - Hollow Metal Frames.
- E. Section 081416 - Flush Wood Doors.
- F. Section 281000 - Access Control: Electronic access control devices.

##### 1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.
- C. BHMA A156.4 - Door Controls - Closers 2019.
- D. BHMA A156.5 - Cylinders and Input Devices for Locks 2020.
- E. BHMA A156.7 - Template Hinge Dimensions 2016.
- F. BHMA A156.16 - Auxiliary Hardware 2018.
- G. BHMA A156.21 - Thresholds 2019.
- H. BHMA A156.22 - Standard for Gasketing 2021.
- I. BHMA A156.28 - Recommended Practices For Mechanical Keying Systems 2018.
- J. BHMA A156.36 - Auxiliary Locks 2020.
- K. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames 2016.
- L. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.
- M. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.
- N. DHI (KSN) - Keying Systems and Nomenclature 2019.
- O. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.
- P. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- Q. ITS (DIR) - Directory of Listed Products Current Edition.
- R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- S. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

- T. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.
- U. UL (DIR) - Online Certifications Directory Current Edition.
- V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- W. UL 294 - Access Control System Units Current Edition, Including All Revisions.
- X. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.
- C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following:
  - 1. Architect.
  - 2. Installer's Architectural Hardware Consultant (AHC).
  - 3. Hardware Installer.
  - 4. Owner's Security Consultant.
- D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- E. Keying Requirements Meeting:
  - 1. Attendance Required:
    - a. Owner.
  - 2. Agenda:
    - a. Establish keying requirements.
    - b. Verify locksets and locking hardware are functionally correct for project requirements.
    - c. Verify that keying and programming complies with project requirements.
    - d. Establish keying submittal schedule and update requirements.
  - 3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
  - 4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
  - 5. Deliver established keying requirements to manufacturers.

#### **1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.
  - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
  - 2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.
    - a. Submit in vertical format.
  - 3. Include complete description for each door listed.
- D. Shop Drawings - Electrified Door Hardware: Include diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:



1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
  2. Elevations: Include front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
  3. Diagrams: Include point-to-point wiring diagrams that show each device in door opening system with related colored wire connections to each device.
- E. Samples for Verification:
1. Submit minimum size of 2 by 4 inch (51 by 102 mm) for sheet samples, and minimum length of 4 inch (102 mm) for other products.
  2. Submit one (1) sample of hinge, latchset, lockset, closer, and \_\_\_\_\_ illustrating style, color, and finish.
  3. Include product description with samples.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Supplier's qualification statement.
- J. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- K. Keying Schedule:
1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- L. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- M. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- N. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.

#### **1.06 QUALITY ASSURANCE**

- A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

#### **1.08 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

1. Closers: Five years, minimum.
2. Locksets and Cylinders: Three years, minimum.

## **PART 2 PRODUCTS**

### **2.01 GENERAL REQUIREMENTS**

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Closers:
  1. Provide door closer on each exterior door, unless otherwise indicated.
  2. Provide door closer on each fire-rated and smoke-rated door.
  3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.
- D. Drip Guards: Provide at head of out swinging exterior doors unless protected by roof or canopy directly overhead.
- E. Thresholds:
- F. Weatherstripping and Gasketing:
  1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
  2. Provide door bottom sweep on each exterior door, unless otherwise indicated.
- G. Fasteners:
  1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
    - a. Aluminum fasteners are not permitted.
    - b. Provide Phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
  2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
    - a. Self-drilling (Tek) type screws are not permitted.
  3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
  4. Provide wall grip inserts for hollow wall construction.
  5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
    - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
    - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

### **2.02 PERFORMANCE REQUIREMENTS**

- A. Provide door hardware products that comply with the following requirements:
  1. Applicable provisions of federal, state, and local codes.
  2. Accessibility: ADA Standards and ICC A117.1.
  3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
  4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), testing firm acceptable to authorities having jurisdiction, or as suitable for application indicated.
  5. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
  6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
  7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.

8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

### 2.03 HINGES

- A. Manufacturers: Conventional butt hinges.
  1. BEST; dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
  2. Ives.
  3. Bommer.
- B. Properties:
  1. Butt Hinges: As applicable to each item specified.
    - a. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
    - b. Template screw hole locations.
    - c. Bearing assembly installed after plating.
    - d. Bearings: Concealed fully hardened bearings.
    - e. Bearing Shells: Shapes consistent with barrels.
    - f. Pins: Easily seated, non-rising pins.
      - 1) Fully plate hinge pins.
      - 2) Non-Removable Pins: Slotted stainless-steel screws.
    - g. UL 10C listed for fire-resistance-rated doors.
- C. Sizes: See Door Hardware Schedule.
  1. Hinge Widths: As required to clear surrounding trim.
  2. Sufficient size to allow 180-degree swing of door.
- D. Finishes: See Door Hardware Schedule.
  1. Fully polish hinges, front, back, and barrel.
- E. Grades:
  1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
- F. Material: Base metal as indicated for each item by BHMA material and finish designation.
- G. Types:
  1. Butt Hinges: Include full mortise hinges.
- H. Options: As applicable to each item specified.
- I. Quantities:
  1. Butt Hinges: Three (3) hinges per leaves up to 90 inches (2286 mm) in height. Add one (1) for each additional 30 inches (762 mm) in height or fraction thereof.
    - a. Hinge weight and size unless otherwise indicated in hardware sets:
      - 1) For doors up to 36 inches (914 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.134 inch (3.4 mm) and a minimum of 4-1/2 inches (114 mm) in height.
      - 2) For doors from 36 inches (914 mm) wide up to 42 inches (1067 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.145 inch (3.7 mm) and a minimum of 4-1/2 inches (114 mm) in height.
      - 3) For doors from 42 inches (1067 mm) wide up to 48 inches (1219 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
      - 4) For doors greater than 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
- J. Applications: At swinging doors.
  1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

- K. Products:
  - 1. Butt Hinges:
    - a. Concealed bearing, five (5) knuckles.

## 2.04 LOCK CYLINDERS

- A. Manufacturers:
  - 1. BEST, dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
- B. Properties:
  - 1. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
    - a. Provide cylinders from same manufacturer as locking device.
    - b. Provide cams and/or tailpieces as required for locking devices.
    - c. Provide cylinders with appropriate format interchangeable cores where indicated.
- C. Grades:
  - 1. Standard Security Cylinders: Comply with BHMA A156.5.
- D. Material:
- E. Types: As applicable to each item specified.
- F. Applications: At locations indicated in hardware sets, and as follows
  - 1. As required for items with locking devices provided by other sections, including at elevator controls and cabinets.
    - a. When provisions for lock cylinders are referenced elsewhere in the Project Manual to this Section, provide compatible type of lock cylinder, keyed to building keying system, unless otherwise indicated.
- G. Products:
  - 1. Rim/mortise.

## 2.05 AUXILIARY LOCKS (DEADLOCKS)

- A. Manufacturers:
  - 1. BEST, dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
  - 2. Sargent.
- B. Properties:
  - 1. Backset: 2-3/4 inch (70 mm), unless otherwise indicated.
  - 2. Strike: Appropriate for door frame.
  - 3. Mortise Deadbolt: Manufacturer's standard, adjustable to accommodate range of door thickness indicated.
    - a. Door Thickness Fit: 1-3/4 inches (44 mm) to 3 inches (76 mm) thick doors.
    - b. Bolt Throw: 1 inch (25.4 mm) stainless steel.
    - c. UL listed for up to 3 hours.
- C. Grades:
  - 1. Mortise Deadbolts: Tested and approved by BHMA A156.36, Operational Grade 1.
  - 2. Cylindrical Deadbolts: Tested and approved by BHMA A156.36, Operational Grade 2.
- D. Products:
  - 1. 48/49H (Mortise).

## 2.06 BEHAVIORAL HEALTH

- A. Manufacturers:
  - 1. BEST, dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
- B. Properties:
  - 1. Locks:
    - a. Fitting modified ANSI A115.1 door preparation.
    - b. Provide TCM - Temperature Control Module.

- c. Latch: solid, one-piece 3/4-inch (19 mm) throw, anti-friction latchbolt made of self-lubricating stainless steel.
  - d. Auxiliary Deadlatch: One-piece stainless steel, permanently lubricated.
  - e. Deadbolt: 1 inch (25.4 mm), minimum, hardened stainless steel.
  - f. Latchbolt and Deadbolt Extension into the Case: A minimum of 3/8 inch (9.5 mm) when fully extended.
  - g. Backset: 2-3/4 inch (70 mm).
  - h. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
  - i. Lever Trim: Forged or cast brass, bronze, or stainless-steel construction.
    - 1) Levers to operate a roller-bearing spindle hub mechanism.
      - (a) Design spindle to prevent forced entry by attack on the lever.
    - 2) Non-moving conical-shape lock escutcheons.
    - 3) Free-moving bidirectional levers regardless of lock function.
  - j. Cylinders: Designed to thread into the lock body.
    - 1) Type: small format interchangeable core.
    - 2) Mortise Cylinders: Include a concealed internal setscrew for securing cylinder to lockset. Design setscrew to be accessible only by removing the core from the cylinder body using the control key.
  - k. Power: 12 VAC.
  - l. Include Temperature Control Module.
- C. Regulatory Acceptance: New York State Office of Mental Health (OMH).
- D. Products:
- 1. SPSL.

## 2.07 CLOSERS

- A. Manufacturers:
- 1. BEST, dormakaba Group [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
  - 2. dormakaba; dormakaba Group: [www.dormakaba.com/us-en/#sle](http://www.dormakaba.com/us-en/#sle).
  - 3. LCN.
- B. Properties:
- 1. Surface Mounted Closers: Manufacturer's standard.
    - a. Construction: R14 high silicon aluminum alloy.
    - b. Mechanism: Separate tamper-resistant adjusting valves for closing and latching speeds.
    - c. Hydraulic Fluid: All-weather type.
    - d. Arm Assembly: Standard for product specified.
      - 1) Material: Steel.
      - 2) Include hold-open, integral stop, or spring-loaded stop feature, as specified in Door Hardware Schedule.
      - 3) Parallel arm to be a heavy-duty rigid arm.
    - e. Covers:
      - 1) Type: Standard for product selected.
        - (a) Full.
      - 2) Material: Plastic.
      - 3) Finish: Painted.
  - 2. Closers Concealed in Door: Manufacturer's standard.
    - a. Listed by UL and CUL for fire-resistance-rated doors.
    - b. Tested and approved for compliance with UL 10C for positive pressure.
    - c. Accessibility: Meet ADA Standards and ICC A117.1.
    - d. California State Fire Marshall Approved.

- e. Cam and roller closers with adjustable spring power.
  - f. Design for installation in the door or inverted in the frame.
  - g. Separate valves for latch speed and sweep speed; accessible with closer installed.
  - h. Adjustable cushioned stop and adjustable hold open where indicated in Door Hardware Schedule.
  - i. Brackets as required to ensure proper installation.
  - j. Auxiliary stop.
- C. Grades:
- 1. Closers: Comply with BHMA A156.4, Grade 1.
    - a. Underwriters Laboratories Compliance:
      - 1) Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.
        - (a) UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.
- D. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.
- 1. Devices listed with California Department of Forestry and Fire Protection, Office of the State Fire Marshal.
- E. Types:
- 1. Rack-and-pinion, surface-mounted. 1-1/2 inches (38 mm) minimum bore.
- F. Installation:
- 1. Mounting: Includes surface mounted and concealed, overhead mounted installations.
  - 2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
  - 3. At out swinging exterior doors, mount closer on interior side of door.
  - 4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
  - 5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
- G. Products:
- 1. Surface Mounted:
    - a. 8900.
  - 2. Concealed - Overhead:
    - a. ITS96.

## 2.08 STOPS AND HOLDERS

- A. Manufacturers:
- 1. Trimco: [www.trimcohardware.com/#sle](http://www.trimcohardware.com/#sle).
  - 2. DonJo.
  - 3. Rockwood.
- B. Grades:
- 1. Wall Bumpers: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.
- C. Material: Base metal as indicated for each item by BHMA material and finish designation.
- D. Types:
- 1. Wall Bumpers: Bumper, concave, wall stop.
- E. Installation:
- 1. Non-Masonry Walls: Confirm adequate wall reinforcement has been installed to allow lasting installation of wall bumpers.
- F. Products:
- 1. Wall Bumpers.

## 2.09 THRESHOLDS

- A. Manufacturers:
  - 1. National Guard Products, Inc: [www.ngpinc.com/#sle](http://www.ngpinc.com/#sle).
  - 2. Pemko.
- B. Properties:
  - 1. Threshold Surface: Fluted horizontal grooves across full width.
- C. Grades: Thresholds: Comply with BHMA A156.21.
- D. Types: As applicable to project conditions. Provide barrier-free type at every location where specified.
  - 1. Interlocking Thresholds: Fluted-top metal member with integral single lip; designed to engage a hook strip applied to door.

## 2.10 WEATHERSTRIPPING AND GASKETING

- A. Manufacturers:
  - 1. National Guard Products, Inc: [www.ngpinc.com/#sle](http://www.ngpinc.com/#sle).
  - 2. Pemko.
- B. Properties:
  - 1. Weatherstripping Air Leakage Performance: Not exceeding 0.3 cfm/sq ft of door opening at 0.3 inches of water pressure differential for single doors, and 0.5 cfm/sq ft of door area at 0.3 inches of water pressure differential for double doors for gasketing other than smoke control, as tested according to ASTM E283/E283M; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
- C. Grades: Comply with BHMA A156.22.
- D. Products:
  - 1. Weatherstripping: See Door Hardware Schedule.

## 2.11 ELECTRIFIED HARDWARE

- A. Manufacturers:
  - 1. BEST, dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
- B. Properties:
  - 1. Door Position Switches: Recessed devices with balanced magnetic contacts.
    - a. Power Requirement: 50mA Max, 100 VDC.
    - b. SPDT configuration with magnetic tamper.
  - 2. Power Supply Units: Manufacturer's standard.
    - a. Regulatory Compliance:
      - 1) United States Compliance:
        - (a) UL listed for Class II Output.
        - (b) Comply with UL 294 Standards incorporating enhanced Access Control communications capabilities.
      - b. Enclosures: NEMA Type 1, with hinged cover and knockouts.
      - c. Power: 24 VAC, 10 Amp; field selectable.
      - d. Emergency Release Terminals: Designed to release devices upon activation of fire alarm system.
      - e. Auxiliary contacts for remote signaling.
      - f. User-selectable time delay from 0 to 4 minutes.
      - g. Fire Alarm System Interface: Standard.
      - h. Output Distribution Board with indicator LEDs.
      - i. On/Off LED power indicator.

## 2.12 KEYS AND CORES

- A. Manufacturers:
  - 1. BEST, dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
- B. Properties: Complying with guidelines of BHMA A156.28.
  - 1. Provide small format interchangeable core.
  - 2. Provide Patented CORMAX keys and cores.
  - 3. Provide keying information in compliance with DHI (KSN) standards.
  - 4. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
  - 5. Keying: Master keyed.
  - 6. Include construction keying and control keying with removable core cylinders.
  - 7. Supply keys in following quantities:
    - a. Master Keys: 4 each.
    - b. Construction Master Keys: 6 each.
    - c. Construction Keys: 15 each.
    - d. Construction Control Keys: 2 each.
    - e. Control Keys if New System: 2 each.
  - 8. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
  - 9. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
  - 10. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
  - 11. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.
- C. Products:
  - 1. Patented:
    - a. CORMAX.

## 2.13 FINISHES

- A. Finishes: Identified in Hardware Sets.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Correct all defects prior to proceeding with installation.
- C. Verify that electric power is available to power operated devices and of correct characteristics.

### 3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware using the manufacturer's fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.
- C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- D. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- E. Use templates provided by hardware item manufacturer.
- F. Do not install surface mounted items until application of finishes to substrate are fully completed.



- G. Wash down masonry walls and complete painting or staining of doors and frames.
- H. Complete finish flooring prior to installation of thresholds.
- I. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list, unless noted otherwise in Door Hardware Schedule or on drawings.
  - 1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
  - 2. For Steel Doors and Frames: See Section 6549.
  - 3. For Steel Door Frames: See Section 081213.
  - 4. Mounting heights in compliance with ADA Standards:
    - a. Locksets: 40-5/16 inch (1024 mm).
    - b. Deadlocks (Deadbolts): 48 inch (1219 mm).
    - c. Door Viewer: 43 inch (1092 mm); standard height 60 inch (1524 mm).
- J. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal, anchor thresholds with stainless steel countersunk screws.
- K. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.

### 3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 014000 - Quality Requirements.

### 3.04 ADJUSTING

- A. Adjust work under provisions of Section 017000 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

### 3.05 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation activities.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.
- D. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

### 3.06 PROTECTION

- A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

### 3.07 HARDWARE SETS

#### Manufacturer List

<u>Code</u>	<u>Name</u>
BE	Best Access Systems
BY	By Related Section
DM	Dorma Door Controls
NA	National Guard
ST	BEST Hinges and Sliding

TR Trimco

**Option List**

<b>Code</b>	<b>Description</b>
BRKTMD	Metal Frame Mounting Kit
C265	CYLINDER CAM
HT	HOSPITAL TIPS-HEAVY WEIGHT
NFHD	Narrow Frame Bracket - Heavy Duty Arms
NRP	NON REMOVEABLE PIN STD/HEAVY WT HINGE
SH	SECURITY HEAD SCREWS
SPANNER 1/4-20 SSMS/LA	STAINLESS SPANNER HEAD MS/LEAD ANCHOR
TORX SCREWS	TORX SCREWS - STAINLESS STEEL
TORX SCREWS 6 X 1"	TORX SECURITY SCREWS 6 X 1"
TX89	Torx Fasteners (Exposed Screws)

**Finish List**

<b>Code</b>	<b>Description</b>
304	Mill Finish Stainless Steel
32D	Satin Stainless Steel
626	Satin Chromium Plated
630	Satin Stainless Steel
689	Aluminum Painted
AL	Aluminum
GREY	Grey

**Hardware Sets**

**Set #01**

Doors: 101A

2	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Electric Hinge	HT CECB199-18 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Elec Lock-Fail Secure Both Sides	SPS3-ML RDL LESS CYLINDER SH	630	BE
2	Mortise Cylinder	1E-74 PATD C265	626	BE
1	Concealed Closer	ITS 9625 BRKTMD	689	DM
NOTE: (Template Installation for Max opening of 130 Degrees.)				
1	Perimeter Gasketing	120 SSS x Tors Screws x LAR	304	NA
1	Door Sweep	C627 A x LAR		NA
1	Drip Cap	16 SS x +4" ODW	304	NA
1	Threshold	896HD x LAR	AL	NA
3	Silencer	1229A	GREY	TR
1	Power Supply	By Access Control Provider		BY
1	Door Position Switch	By Access Control Provider		BY
4	Card Reader	By Access Control Provider		BY

**Set #02**

Doors: A-1C, B-1C, C-1C, D-1C

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2	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Electric Hinge	HT CECB199-18 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Elec Lock-Fail Secure Both Sides	SPS3-ML RDL LESS CYLINDER SH	630	BE
2	Mortise Cylinder	1E-74 PATD C265	626	BE
1	Concealed Closer	ITS 9625 BRKTMD	689	DM
NOTE: (Template Installation for Max opening of 130 Degrees.)				
1	Perimeter Gasketing	120 SSS x Tors Screws x LAR	304	NA
1	Door Sweep	C627 A x LAR		NA
1	Drip Cap	16 SS x +4" ODW	304	NA
1	Threshold	896HD x LAR	AL	NA
3	Silencer	1229A	GREY	TR
1	Power Supply	By Access Control Provider		BY
1	Door Position Switch	By Access Control Provider		BY

**Set #03**

Doors: 104A

2	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Electric Hinge	HT CECB199-18 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Elec Lock-Fail Secure Both Sides	SPS3-ML RDL LESS CYLINDER SH	630	BE
2	Mortise Cylinder	1E-74 PATD C265	626	BE
1	Concealed Closer	ITS 9625 BRKTMD	689	DM
NOTE: (Template Installation for Max opening of 130 Degrees.)				
1	Perimeter Gasketing	120 SSS x Tors Screws x LAR	304	NA
1	Door Sweep	C627 A x LAR		NA
1	Drip Cap	16 SS x +4" ODW	304	NA
1	Threshold	896HD x LAR	AL	NA
3	Silencer	1229A	GREY	TR
1	Power Supply	By Access Control Provider		BY
1	Door Position Switch	By Access Control Provider		BY
2	Card Reader	By Access Control Provider		BY

**Set #04**

Doors: 108A, 108B

3	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Electric Hinge	HT CECB199-18 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Elec Lock-Fail Secure Both Sides	SPS3-ML RDL LESS CYLINDER SH	630	BE
2	Mortise Cylinder	1E-74 PATD C265	626	BE
1	Concealed Closer	ITS 9613 BRKTMD	689	DM
NOTE: (Template Installation for 90 Degrees.)				
1	Perimeter Gasketing	120 SSS x Tors Screws x LAR	304	NA
3	Silencer	1229A	GREY	TR
1	Power Supply	By Access Control Provider		BY
1	Door Position Switch	By Access Control Provider		BY
2	Card Reader	By Access Control Provider		BY

**Set #05**

Doors: A-1A, B-1A, C-1A, D-1A

2	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Electric Hinge	HT CECB199-18 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Elec Lock-Fail Secure Both Sid	SPS3-ML RDL LESS CYLINDER SH	630	BE

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2	Mortise Cylinder	1E-74 PATD C265	626	BE
1	Concealed Closer	ITS 9613 BRKTMD	689	DM
		NOTE: (Template Installation for Max opening of 130 Degrees.)		
1	Perimeter Gasketing	120 SSS x Tors Screws x LAR	304	NA
3	Silencer	1229A	GREY	TR
1	Power Supply	By Access Control Provider		BY
1	Door Position Switch	By Access Control Provider		BY

**Set #06**

Doors: A-1B, B-1B, C-1B, D-1B

3	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Passage Set	SPSL-MLON16F SH	630	BE
1	Mortise Cylinder	1E-74 PATD C265	626	BE
1	Concealed Closer	ITS 9613 BRKTMD	689	DM
		NOTE: (Template Installation for Max opening of 130 Degrees.)		
3	Silencer	1229A	GREY	TR

**Set #07**

Doors: 105A

3	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Lockset-Office	SPSL-MLA16F SH	630	BE
1	Mortise Cylinder	1E-74 PATD C265	626	BE
3	Silencer	1229A	GREY	TR

**Set #08**

Doors: 102A, 106A

3	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Lockset-Storeroom	SPSL-MLD16F SH	630	BE
1	Mortise Cylinder	1E-74 PATD C265	626	BE
1	Concealed Closer	ITS 9613 BRKTMD	689	DM
		NOTE: (Template Installation for Max opening of 130 Degrees.)		
3	Silencer	1229A	GREY	TR

**Set #09**

Doors: 103A

3	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Privacy Set	SPSL-MLLT16F SH	630	BE
1	Coat Hook	3072	630	TR
3	Silencer	1229A	GREY	TR

**Set #10**

Doors: NC-1A, SC-1A

3	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Deadlock	48H-7R PATD SH	626	BE
1	Flush Pull	1115B	630	TR
1	Closer	8916 S-DS NFHD TX89	689	DM

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1	Perimeter Gasketing	120 SSS x Tors Screws x LAR	304	NA
1	Drip Cap	16 SS x +4" ODW	304	NA
1	Threshold	896HD x LAR	AL	NA
3	Silencer	1229A	GREY	TR

**Set #11**

Doors: 107A

2	Hinges	HT CB199 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Electric Hinge	HT CECB199-18 4.5" x 4.5" NRP TORX SCREWS	32D	ST
1	Elec Lock-Fail Secure Exterior	SPSE-ML RDL LESS CYLINDER SH	630	BE
1	Mortise Cylinder-Exterior	1E-74 PATD C265	626	BE
1	Concealed Closer	ITS 9625 BRKTMD	689	DM
NOTE: (Template Installation for Max opening of 130 Degrees.)				
1	Perimeter Gasketing	120 SSS x Tors Screws x LAR	304	NA
3	Silencer	1229A	GREY	TR
1	Power Supply	By Access Control Provider		BY
1	Door Position Switch	By Access Control Provider		BY
1	Card Reader	By Access Control Provider		BY

**Opening List**

<b><u>Opening</u></b>	<b><u>Hdw Set</u></b>
101A	01
102A	08
103A	09
104A	03
105A	07
107A	11
108A	04
108B	04
A-1A	05
A-1B	06
A-1C	02
B-1A	05
B-1B	06
B-1C	02
C-1A	05
C-1B	06
C-1C	02
D-1A	05
D-1B	06
D-1C	02
NC-1A	10
SC-1A	10

**END OF SECTION**

## SECTION 08 80 00 - GLAZING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

- Windows.
- Doors.
- Storefront framing.
- Glazed entrances.
- Interior borrowed lites.

- B. Related Sections:

- Division 08 Section "Hollow Metal Doors and Frames"
- Division 08 Section "Flush Wood Doors"
- Division 08 Section "Exterior Aluminum Framed Entrances & Storefronts"
- Division 08 Section "Safety and Security Window Film" for exterior glazing.

#### 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. Interspace: Space between lites of an insulating-glass unit.

#### 1.4 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: Design glass, including comprehensive engineering analysis according to FBC's 2007 Florida Building Code by a qualified professional engineer, using the following design criteria:

- Design Wind Pressures: Design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

- a. Ultimate Design Wind Speed: **145mph** (with Safety and Security Window Film)
- b. Exposure Category: **C**.
- c. Risk Category **IV**.

- Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.

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, whichever is less.

Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing will not be 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 sufficient 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.

## 1.6 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
1. Tinted glass.
  2. Coated glass.
  3. Laminated glass with colored interlayer.
  4. Insulating glass.
- C. Glazing Accessory Samples: For gaskets sealants and colored spacers, in 12-inch 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.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers, manufacturers of insulating-glass units with sputter-coated, low-e coatings, glass testing agency and sealant testing agency.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for tinted glass coated glass insulating glass glazing sealants and glazing gaskets.



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. Warranties: Sample of special warranties.

#### 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved 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.
- E. Source Limitations for Glass: Obtain tinted float glass coated float glass laminated glass and insulating glass from single source from single manufacturer for each glass type.
- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
  2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- I. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  1. Install glazing in mockups specified in Division 08 Section "Aluminum-Framed Entrances and Storefronts, Aluminum Windows, Glazed Aluminum Curtain Walls" to match glazing systems required for Project, including glazing methods.
  2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- J. Pre-installation 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 temporary protection requirements for glazing during and after installation.

#### 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 recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

## 1.10 PROJECT 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 below 40 deg F.

## 1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass 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.

Warranty Period: Ten (10) years from date of Substantial Completion.

- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which 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.

Warranty Period: Ten (10) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm (1/4").
  2. Thickness of Coated/Tinted Glass: Provide same thickness for tint color indicated throughout Project.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes enhanced-protection testing requirements in ASTM E 1996 for Wind Zone 4 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
1. Large-Missile Test: For glazing located within 30 feet of grade.
  2. Small-Missile Test: For glazing located more than 30 feet above grade.
- D. 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 6.0 mm min. 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.
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.

## 2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

For uncoated glass, comply with requirements for Condition A.

For coated vision glass, comply with requirements for Condition C (other coated glass).

- C. Coated/Tinted Float Glass: Class 2, complying with other requirements specified.

Basis-of-Design Product: Subject to compliance with requirements, provide  
AGC Energy Select™ 23; ¼" low-e outboard with coating on surface #2; ¼" clear inboard lite.  
Or

PPG Solarban 70XL(2); Solarblue Glass ¼", 6mm

## 2.3 LAMINATED GLASS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. PPG Solarban 70XL(2); Solar blue
  2. AGC Energy Select™ 23
- B. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, with "Windborne-Debris-Impact Resistance" Paragraph in "Glass Products, General" Article, and with other requirements specified. 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 one of the following to comply with interlayer manufacturer's written recommendations:
    - a. Polyvinyl butyral interlayer.
    - b. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
  2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
  3. Interlayer Color: Clear unless otherwise indicated.
- C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

## 2.4 INSULATING GLASS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. PPG Solarban 70XL(2) - Solarblue.
  - 2. AGC Energy Select™ 23
  
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
  - 1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary.
  - 2. Spacer: Polypropylene covered stainless steel in color selected by Architect.
  - 3. Desiccant: Molecular sieve or silica gel, or blend of both.
  
- C. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

## 2.5 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
  - Neoprene complying with ASTM C 864.
  - EPDM complying with ASTM C 864.
  - Silicone complying with ASTM C 1115.
  - Thermoplastic polyolefin rubber complying with ASTM C 1115.

## 2.6 GLAZING SEALANTS

- A. General:
  - Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will 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.
  - 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.
  - Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
  
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
  - Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 790.
    - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
    - c. Pecora Corporation; 890.
    - d. Sika Corporation, Construction Products Division; SikaSil-C990.
    - e. Tremco Incorporated; Spectrem 1.

- C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

## 2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, 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.
- G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

## 2.8 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.
- 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.

## 2.9 INSULATING-LAMINATED-GLASS TYPES

- A. Low-e-coated, tinted, insulating laminated glass.
  - 1. Overall Unit Thickness: 1-1/4 inch maximum.
  - 2. Thickness of Outdoor Lite: 6.0 mm.
  - 3. Outdoor Lite: Tinted/Coated (Solarblue) fully tempered float glass.
  - 4. Interspace Content: Argon.
  - 5. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.
    - a. Thickness of Each Glass Ply: 6.0 mm.
    - b. Interlayer Thickness: 0.090 inch .
  - 6. Low-E Coating: Sputtered on second surface.
  - 7. Visible Light Transmittance: 50 percent minimum.
  - 8. Winter U-Factor: 0.29 maximum.
  - 9. Summer U-Factor: 0.26 maximum.
  - 10. Solar Heat Gain Coefficient: 0.23 maximum.
  - 11. Provide safety glazing labeling.

## 2.10 MONOLITHIC-GLASS TYPES

- A. Clear fully tempered interior float glass.
  - Thickness: 1/4", 6.0 mm minimum.

Provide safety glazing labeling.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  - Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - Presence and functioning of weep systems.
  - Minimum required face and edge clearances.
  - 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 will 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. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. 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.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches .

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.

Provide 1/8-inch 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.

- H. 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.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

- J. Where glazing is installed in butt-glazed applications, install glazing so that all bowing of glass units is in the same direction. Adjust glazing panel locations to minimize panel-to-panel offset.
- K. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- L. 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.
- M. 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 GASKET GLAZING (DRY – Interior Only)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. 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.
- C. 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.
- D. Install gaskets so they protrude past face of glazing stops.

#### 3.5 SEALANT GLAZING (WET - Exterior)

- 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.

#### 3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project 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 08 80 00



## SECTION 08 88 53 - SECURITY GLAZING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes glass-clad polycarbonate (bullet resistant glass/glazing) for the following applications:
  - 1. Windows.
  - 2. Doors.

#### 1.3 DEFINITIONS

- A. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.

#### 1.4 COORDINATION

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

#### 1.5 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 temporary protection requirements for security glazing during and after installation.

#### 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Security Glazing Samples: For each type of security glazing; 12 inches (300 mm) square.
- C. Glazing Accessory Samples: For sealants, in 12-inch (300-mm) lengths.

#### 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers and manufacturers of security glazing.
- B. Product Certificates: For each type of product indicated, from manufacturer.

- C. Product Test Reports: For each type of security glazing, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- D. Product Test Reports: For each type of glazing sealant, for tests performed by a qualified testing agency.
- E. Preconstruction adhesion and compatibility test reports.
- F. Sample Warranties: For special warranties.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.
- B. Security Glazing Testing Agency Qualifications: Subject to compliance with requirements, testing agency is one of the following:
  - 1. H. P. White Laboratory, Inc.
  - 2. Underwriters Laboratories, Inc.
  - 3. Wiss, Janney, Elstner Associates, Inc.
- C. Sealant Testing Agency Qualifications: Qualified according to ASTM C1021 for testing indicated.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

#### 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 below 40 deg F (4.4 deg C).

#### 1.11 WARRANTY

- A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated glass that deteriorates 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.
- B. Manufacturer's Special Warranty for Glass-Clad Polycarbonate: Manufacturer agrees to replace glass-clad polycarbonate that deteriorates within specified warranty period. Deterioration of glass-clad polycarbonate is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning glass-clad polycarbonate contrary to manufacturer's written instructions.

Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Security Glazing: Obtain security glazing from single source from single manufacturer using the same types of lites, plies, interlayers, and spacers for each security glazing type indicated.
- B. Source Limitations for Glazing Sealants and Gaskets: Obtain from single source from single manufacturer for each product and installation method.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General:
  1. Installed security glazing shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing; or other defects in construction.
  2. Installed security glazing shall withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated.
  1. Design Procedure for Glass: ASTM E1300 and ICC's International Building Code.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glazing framing members and glazing components.
  1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

### 2.3 SECURITY GLAZING, GENERAL

- A. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below unless more stringent requirements are indicated. Refer to 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."
- B. Thermal and Optical Performance Properties: Provide security glazing with performance properties specified, as indicated in manufacturer's published test data, based on construction products indicated and on procedures indicated below:

1. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

## 2.4 GLASS PRODUCTS

- A. Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
  1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
  2. For heat-strengthened float glass, comply with requirements for Kind HS.
  3. For fully tempered float glass, comply with requirements for Kind FT.
  4. For uncoated glass, comply with requirements for Condition A.
  5. For coated vision glass, comply with requirements for Condition C (other coated glass).

## 2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
  1. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
  2. Interlayer Color: Clear unless otherwise indicated.

## 2.6 POLYCARBONATE SECURITY GLAZING

- A. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on exposed surfaces and Type I, standard, UV-stabilized polycarbonate where no surfaces are exposed.
- B. Laminated Polycarbonate: Polycarbonate sheets laminated with clear urethane interlayer that complies with ASTM C1349, Appendix X2, and has a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Provide laminated units that comply with requirements of ASTM C1349 for maximum allowable laminating process blemishes and haze.
- C. Glass-Clad Polycarbonate: ASTM C1349.

## 2.7 GLAZING SEALANTS

- A. General:
  1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, 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 security glazing 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 selected by Architect from manufacturer's full range.
- B. Security Sealant: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement complying with ASTM C920, Grade NS, Class 12.5 or 25, Use NT, and with a Shore A hardness of at least 45 when tested according to ASTM C661.

## 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 security glazing manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
  - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  - 2. 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, requirements of manufacturers of security glazing 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 security glazing manufacturer to maintain security glazing lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit security glazing lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, 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 SECURITY GLAZING

- A. Fabricate security glazing 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.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing for security glazing, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Minimum required face or edge clearances.
  - 3. Minimum required bite.
  - 4. Effective sealing between joints of 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 security glazing 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 will leave visible marks in the completed work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and 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 glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.
- F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches (1270 mm).
  - 1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. 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 performance requirements.
  - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glazing lites 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 security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.
- H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.
- I. 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.
- J. 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 security glazing, 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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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 just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center security glazing 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 securely in place between glazing unit 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 security glazing 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 security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center security glazing 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 security glazing. 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 security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. 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 security glazing and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial washaway from security glazing.

### 3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. 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 security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.
- C. Wash security glazing on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

### 3.8 GLASS-CLAD POLYCARBONATE GLAZING SCHEDULE

- A. Security Glazing: **Clear, containment-grade polycarbonate.**
  - 1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Manufacturer: Global Security Glazing – Secur-Tem + Poly or Lexgard
  - 2. Protection Level: **HP White Level I-TP-0500.02.**
  - 3. Maximum Overall Unit Thickness: 11mm
  - 4. Overall Visible Light Transmittance: .64.
  - 5. Provide safety glazing labeling.

END OF SECTION 08 88 53



## **SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
2. Interior and exterior security barrier mesh and attachment system.
3. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

- B. Related Sections include the following:

1. Division 05 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; roof rafters and ceiling joists.
2. Division 07 Section "Thermal Insulation" for insulation.
3. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non-load-bearing steel framing.
4. Division 09 Section "Gypsum Board" for finish board over non-load-bearing steel framing.

#### 1.3 SUBMITTALS

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

#### 1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

### PART 2 - PRODUCTS

#### 2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized, unless otherwise indicated.

## 2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
  - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Provide rigid supports as required to meet wind load requirements where applicable.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
  - 1. Depth: As indicated on Drawings or, if not indicated, minimum 1-1/2 inches.
- F. Furring Channels (Furring Members):
  - 1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
  - 2. Steel Studs: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0375 inch (20-gauge).
    - b. Depth: As indicated on Drawings or, if not indicated, minimum 3-5/8 inches.
  - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base Metal Thickness: 0.0375 inch (20-gauge).
  - 4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
    - a. Configuration: Asymmetrical or hat shaped.
- G. Security Mesh System:
  - 1. Interior Material: Type II, Class 1 - Carbon Steel - Mesh, Complying to ASTM F1267
  - 2. Exterior Material: Type II, Class 2 - Galvanized available by special order.
  - 3. Basis-of-Design: ClarkDietrich Model #BM75, 16-gauge (0.048-Inches), 3/4-inch diamond.
  - 4. Bond Size: .923" x 2.10"
  - 5. Weight (lbs/100-Ft<sup>2</sup>): 47
  - 6. Percent of Open Area: 76
  - 7. See Floor and Roof Plans and Wall Types in Drawings for locations.

## 2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
  - 1. Minimum Base-Metal Thickness for Non-Security Walls: 0.0375 inch (20-gauge).
  - 2. Minimum Security Wall and Roof Protection Walls Metal Thickness: 14-gauge (0.064-Inches) studs and 16-gauge (0.051-inch) tracks (also see structural Drawings).

3. Depth: As indicated on Drawings or, if not indicated, minimum 3-5/8 inches.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
  3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Superior Metal Trim; Superior Flex Track System (SFT).
- C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
    - b. Metal-Lite, Inc.; The System.
- D. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: As indicated on Drawings or, if not indicated, minimum 1-1/2 inches.
  2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: 0.0179 inch.
  2. Depth: 7/8 inch.
- F. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
- G. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: 3/4 inch.
  2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
  3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch , minimum bare-metal thickness of 0.0179 inch , and depth required to fit insulation thickness indicated.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
  - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
  - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
  - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

#### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
  - 1. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
  - 2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.

- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4. Do not attach hangers to steel roof deck.
  - 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  - 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

### 3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
  - 1. Space studs as follows:
    - a. Single-Layer Application: 16 inches o.c., unless otherwise indicated.
    - b. Multilayer Application: 16 inches o.c., unless otherwise indicated.
    - c. Tile backing panels: 16 inches o.c., unless otherwise indicated.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb, unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
  6. Curved Partitions:
    - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.
- D. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Z-Furring Members:
1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.
  2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
  3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

## **SECTION 09 29 00 - GYPSUM BOARD**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Interior gypsum board.
- B. Related Sections include the following:
  - 1. Division 05 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
  - 2. Division 06 Section "Rough Carpentry" for wood blocking and furring that supports gypsum board.
  - 3. Division 06 Section "Sheathing" for exterior Glass Matt Faced Gypsum Sheathing
  - 4. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
  - 5. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board.
  - 6. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
  - 7. Division 09 Section "Tiling" for cementitious backer units installed as substrates for ceramic tile.
  - 8. Division 09 Painting Sections for primers applied to gypsum board surfaces.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Submittals:
  - 1. Product Data for adhesives used to laminate gypsum board panels to substrates, documentation including printed statement of VOC content.
  - 2. Laboratory Test Reports for adhesives used to laminate gypsum board panels to substrates, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Samples: For the following products:
  - 1. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

#### 1.4 QUALITY ASSURANCE

- 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.
- C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Install mockups for the following:
    - a. Each level of gypsum board finish indicated for use in exposed locations.
    - b. Each texture finish indicated.
  - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
  - 3. Simulate finished lighting conditions for review of mockups.
  - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.5 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are 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 in 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. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, and ASTM C1629 as applicable to type of gypsum board indicated and whichever is more stringent.
1. 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:
    - a. Standard gypsum board products
      - 1) American Gypsum Co.
      - 2) BPB America Inc.
      - 3) G-P Gypsum.
      - 4) Lafarge North America Inc.
      - 5) National Gypsum Company.
      - 6) PABCO Gypsum.
      - 7) Temple.
      - 8) USG Corporation.
- B. Regular Type (only in non-student private spaces and service areas and above 7-feet above floor level):
1. Thickness: 5/8 inch .
  2. Long Edges: Tapered or Tapered and featured (rounded or beveled) for prefilling.
  3. Moisture resistant type where indicated.
- C. Ceiling Type: Moisture resistant manufactured to have more sag resistance than regular-type gypsum board.
1. Thickness: 5/8 inch .
  2. Long Edges: Tapered.
- D. Type C (or X):
1. Thickness: 5/8 inch.
  2. Long Edges: Tapered.

## 2.4 TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: ASTM C1396/C1396M, with manufacturer's standard edges.
1. Core: 5/8 inch (15.9 mm), Type X or Type C as required by fire-resistance-rated assembly indicated on Drawings.

## 2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, Rolled zinc or Plastic.
  2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.

- g. Curved-Edge Cornerbead: With notched or flexible flanges.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Wallboard: Paper.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
  - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
  - 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
  - 2. Cementitious Backer Units: As recommended by backer unit manufacturer.
  - 3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

## 2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. 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 thick.
- C. 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.
- D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
- E. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

## 2.8 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. G-P Gypsum; Georgia-Pacific Ceiling Textures/Vermiculite.
    - b. USG Corporation; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).

2. Texture: Light spatter.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- 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 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. 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- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- 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 recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

#### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  1. Regular Type: At non-student and/or private spaces, and above 7-feet in all areas. Vertical surfaces, unless otherwise indicated.
  2. Type C (or X): Where required for specific fire-resistance-rated assembly indicated.

3. Ceiling Type: Ceiling surfaces.

B. 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 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-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.

### 3.4 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 at locations indicated on Drawings and/or according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners.
  2. LC-Bead: Use at exposed panel edges.
  3. Curved-Edge Cornerbead: Use at curved openings.

### 3.5 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 those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  1. Level 1: Ceiling plenum areas and concealed areas.
  2. Level 2: Panels that are substrate for tile.
  3. Level 3: At panel surfaces that will have a light textured wall finish.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.
  4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.6 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

### 3.7 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. 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 09 29 00

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## SECTION 09 51 23 - ACOUSTICAL TILE CEILINGS

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. Standard ceiling tiles, metal grid, ceiling suspension system and related accessories required for complete and functioning ceiling system.
- B. Special integrated ceiling system with ceiling tiles, metal grid, ceiling suspension system and related accessories required for complete and functioning ceiling system.
- C. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 RELATED SECTIONS

- A. Section 00 82 00 – Special Conditions - Product Substitution Procedures.
- B. Section 01 31 00 – Project Coordination.
- C. Section 01 33 00 - Submittal Procedures.
- D. Section 01 42 00 – References.
- E. Section 01 40 00 - Quality Control.
- F. Section 01 77 00 – Closeout Submittals.
- G. Section 04 20 00 – Concrete Unit Masonry.
- H. Section 09 29 00 – Gypsum Board Assemblies.
- I. Section 09 53 23 – Linear Metal Ceilings
- J. Section 21 05 18 - Escutcheons for Fire-Suppression Piping
- K. Section 23 37 13 – Air Outlets and Inlets.
- L. Section 26 09 23 – Lighting Control Devices.
- M. Section 26 51 19 – Interior Lighting.
- N. Section 27 40 00 – Sound Reinforcement System.
- O. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.3 REFERENCES

- A. Comply with Section 01 42 00 – References for additional reference standards, abbreviations, definitions and acronyms.
- B. American Society of Testing Materials (ASTM):
  - 1. ASTM C423-09: Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - 2. ASTM C635-13: Standard Specification the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
  - 3. ASTM C636-13: Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
  - 4. ASTM C641-09: Specification for Steel Sheet, Zinc-Coated (galvanized) Carbon Steel Wire
  - 5. ASTM A653-13: Specification for Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (galvanized) by the Hot-Dip Process
  - 6. ASTM E84-14: Test Method for Surface Burning Characteristics of Building Materials
  - 7. ASTM E119-12a: Standard Test Method for Fire Test of Building Construction and Materials
  - 8. ASTM E795-05(12): Standard Practice for Mounting Test Specimens During Sound Absorption Tests
  - 9. ASTM E1264-08e1: Standard Classification of Acoustical Ceiling Products

10. ASTM E1414-11a: Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
11. ASTM E1477-98a (2013): Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating Sphere Reflectometer

C. Ceilings and Interior Systems Contractors Association (CISCA):

1. Acoustical Ceilings: Use and Practice.
2. Ceiling Systems Handbook.

D. International Organization of Standardization (ISO):

1. ISO 11654:1997 – Sound Absorbers for use in Buildings – Rating of Sound Absorption
2. ISO 14024:1999 – Environmental Labels and Declarations- Type I Environmental Labeling – Principles and Procedures
3. ISO 14025:2006 – Environmental Labels and Declarations- Type III Environmental Labeling – Principles and Procedures

E. Underwriter's Laboratories (UL): Fire Resistance Directory and Building Material Directory.

#### 1.4 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.
- B. Submit product data for each type of product specified.
- C. Submit samples for verification purposes of each type of exposed finish required, prepared on samples of size indicated below and of same thickness and material indicated for final unit of Work.
- D. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.
  1. Submit 150 mm (6") square samples of each acoustical panel type, pattern, and color.
  2. Submit two (2) 300 mm (12") long samples of exposed suspension system members, including moldings, for each color and system type required.

#### 1.5 QUALITY ASSURANCE

- A. Comply with Section 01 45 00 – Quality Control.
- B. Comply with CISCA "Ceiling Systems Handbook" and "Acoustical Ceilings: Use and Practice.
- C. Fire Performance Characteristics: Provide acoustical ceilings in accord with ASTM indicated:
  1. ASTM E 84-14: Flame Spread of 25 or less, and Smoke Developed of 50 or less.
  2. ASTM E 1264-08e1: Tile products rated Class A.
- D. Single Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling unit from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of Work.
- E. Single Source Responsibility for Suspension System: Obtain each type of suspension system from single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of Work.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units and suspension system components to Project site in original, unopened packages and store in fully enclosed space.
- B. Protect from damage due to moisture, direct sunlight, surface contamination, and other causes.
- C. Before installation, permit tiles to reach room temperature and attain stabilized moisture content



- D. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units. Replace damaged units.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install interior acoustical ceilings until interior spaces are enclosed and weatherproof, wet finish work is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity are continuously maintained per manufacturer's printed product installation instructions.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
- B. Acoustical Ceiling Units: Furnish two boxes of 2' (608mm) x 2'(608mm) replacement tiles on project site for Owner's use upon completion of work.

## 1.9 WARRANTY

- A. Comply with Section 01 78 00 – Submittal Documents.
- B. Submit printed warranty executed by manufacturer agreeing to repair or replace acoustic panels from sagging or warping, grid system from rusting or other manufacturing defects for ten years from date of project's substantial completion.
- C. Warranty shall not cover abuse or acts of God.

## PART 2 - PRODUCTS

### 2.1 APPROVED MANUFACTURERS

- A. Armstrong World Industries, Inc., P.O. Box 3001, Lancaster, PA 17604; Tel: 877-276-7876; Fax: 800-572-8324; Website: [www.armstrong.com](http://www.armstrong.com)
- B. USG Interiors, subsidiary of USG Corp., 550 West Adams St.. Chicago, IL 60661-3637; Tel: 800-950-3839; Website: [usg.com](http://usg.com).
- C. Certainteed Corporation, subsidiary of Saint Gobain, P.O. Box 860, 750 East Swedesford Rd., Valley Forge, PA 19482; Tel: 800-233-8990, 610-341-7777; Website: [www.certainteed.com](http://www.certainteed.com).
- D. Other manufacturers may request approval in accord with Section 01 25 13 – Product Substitution Procedures.

### 2.2 PRODUCTS

- A. Standard ceiling tile systems shall be 24" (608mm) x 24" (608mm) x 3/4" (19.5mm) thick white, tegular edge, non-directional, fissured, with 15/16" (23.8mm) wide white grid unless noted otherwise.
  - 1. Ceiling Tile Locations:  
**ACT-1** (Non wet areas such as Court Room and Break Room, etc.):
    - a. Armstrong World Industries "Fine Fissured"
    - b. CertainTeed Corp. "Baroque"
    - c. USG Interiors Radar Climaplus

### 2.3 CEILING UNITS

- A. Standard for Acoustical Ceiling Units: ASTM E 1264-08e1 classifications as designated by reference to types, patterns, acoustical ratings, and light reflectance, unless otherwise indicated.
- B. Mounting Method for Measuring NRC: Type E 400 (plenum mounting in which face of test specimen is 15-3/4" (400 mm) away from the test surface) per ASTM E 795-05(12).
- C. Colors and Patterns: Provide products to match appearance characteristics indicated under each product type – Color white.

## 2.4 SUSPENSION SYSTEM

- A. Standard for Metal Suspension Systems: comply with applicable ASTM C 635-13 requirements.
- B. Finishes and Colors: Provide manufacturer's standard factory applied finish for type of system indicated.
- C. Attachment Devices: Size for 5 times design load indicated in ASTM C 635-13, Table 1, Direct Hung unless otherwise indicated.
- D. Wire Hangers, Braces, and Ties: ASTM C 641-09, Class 1 zinc coating, soft temper.
  - 1. Gage: Provide wire sized so that stress at 3 times hanger design load (ASTM C 635-13, Table 1, Direct-Hung), will be less than yield stress of wire, but provide not less than 2.69 mm (0.106") diameter wire.
- E. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit type of edge detail and suspension system indicated. Provide column surround trim at round columns. Provide pre-manufactured corners for special integrated ceiling shadow-line perimeter edges.
- F. Retention Clips (For Fire Rated Ceiling Assemblies): Armstrong #414 or equal by other approved acoustical panel manufacturers.

## 2.5 NON-FIRE-RESISTANCE-RATED DIRECT-HUNG SUSPENSION SYSTEMS

- A. Wide-Face Capped Double-Web Steel Suspension System: Main and cross-runners roll-formed from pre-painted or electrolytic zinc-coated cold-rolled steel sheet, with pre-finished 23 mm (15/16") wide metal caps on flanges; other characteristics as follows:
  - 1. Structural Classification: Intermediate Duty System.
  - 2. End Condition of Cross-Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
  - 3. Cap Material and Finish: Steel sheet painted white.

## 2.6 MISCELLANEOUS MATERIALS

- A. Tile Adhesive: Type recommended by tile manufacturer, bearing UL label for Class 0-25 flame spread

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and structural framing to which ceiling system attaches or abuts, with Installer, for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system.
- B. Proceeding with installation shall be deemed installer's acceptance of surface conditions to which ceiling system is attached or abutting.

### 3.2 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
- B. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.
- C. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans.

### 3.3 INSTALLATION

- A. General: Ceiling systems installation shall be in accord with manufacturer's written instructions and CISCA "Ceiling Systems Handbook", and Standard for Installation of Ceiling Suspension Systems: ASTM C 636-13.
- B. Arrange acoustical units as indicated.
  - 1. Where ACT units are installed, provide retention clips in accord with ceiling panel manufacturer's recommendations.
- C. Suspend ceiling hangers from building structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacing that interferes with location of hangers at spacing required to properly support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
  - 5. Secure wire hangers by looping and wire tying, either directly to structures or to inserts, eye-screws, or other devices that are secure and appropriate for substrate, and in manner that will not cause deterioration or otherwise fail due to age, corrosion, or elevated temperatures.
  - 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye-screws, or other devices that are secure and appropriate for structure to which hangers are attached and for type of hanger involved, and in manner that will not cause deterioration or fail due to age, corrosion, or elevated temperatures.
  - 7. Space hangers not more than 48" (1216 mm) along each member supported directly from hangers, unless otherwise shown, and provide hangers not more than 8" (200 mm) from ends of each member.
  - 8. Lighting, speakers or other items inserted into ceiling tiles shall be supported by building structure and not by ceiling tile or grid.
- D. Install edge moldings of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical units.
- E. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

### 3.4 CLEANING

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members.
- B. Comply with manufacturer's printed instructions for cleaning and touch-up of minor finish damage.
- C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23

## **SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Resilient base.
- 2. Resilient molding accessories.
- 3. Resilient stair accessories.

- B. Related Sections:

- 1. Division 09 Section "Carpet Tile Flooring" for carpet floor coverings.
- 2. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.
- D. Product Schedule: For resilient products. Use same designations indicated on Drawings.

#### 1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Mockups: Provide resilient products with mockups specified in other Sections.

#### 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 or more than 90 deg F .

#### 1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
  2. During installation.
  3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

## 1.7 EXTRA MATERIALS

- 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 not less than 2 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

## PART 2 - PRODUCTS

### 2.1 RESILIENT BASE (STANDARD)

- 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. Armstrong World Industries, Inc.
  2. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
  3. Johnsonite (Tarkett – Basis of Design)
  4. Musson, R. C. Rubber Co.
  5. Roppe Corporation, USA.
- B. Resilient Base Standard: ASTM F 1861.
1. Material Requirement: Type TP (rubber, thermoplastic).
  2. Manufacturing Method: Group I (solid, homogeneous).
  3. Style: Cove (base with toe) and Straight (flat or toeless).
  4. Minimum Thickness: 0.125 inch.
  5. Height: 6 inches.
  6. Lengths: Coils in manufacturer's standard length.
  7. Outside Corners: Preformed.
  8. Inside Corners: Job formed or preformed.
  9. Finish: As selected by Architect from manufacturer's full range.
  10. Colors: 33 - Ink.

### 2.2 RESILIENT MOLDING ACCESSORY

- A. Description: Nosing for carpet, Nosing for resilient floor covering, Reducer strip for resilient floor covering, Joiner for tile and carpet and Transition strips.
- B. Material: Rubber.
- C. Profile and Dimensions: As required for each condition.

### 2.3 RESILIENT STAIR ACCESSORIES

- A. Basis of Design: Tarkett Johnsonite – All Stairs
  - 1. Treads: Angled fit rubber treads (without integrated risers):
    - a. Tread Color: N/A
    - b. Tread Texture: N/A
  - 2. Risers: Full fit:
    - a. Riser Color: N/A
  - 3. Stringers:
    - a. Color: N/A

## 2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
  - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Cove Base Adhesives: Not more than 50 g/L.
    - b. Rubber Floor Adhesives: Not more than 60 g/L.

## 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.
- B. 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.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
  - 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

- a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
  1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

### 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 practicable 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. Inside Corners: Use straight pieces of maximum lengths possible.

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
  1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
  2. Tightly adhere to substrates throughout length of each piece.
  3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
  1. Remove adhesive and other blemishes from exposed surfaces.
  2. Sweep and vacuum surfaces thoroughly.
  3. Damp-mop surfaces to remove marks and soil.



- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13

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## SECTION 09 91 13 - EXTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Provide preparations and paint systems for all non-factory finished exposed and semi-exposed exterior surfaces unless finished by specifications in individual Sections.
- B. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
  - 1. Steel and iron.
  - 2. Galvanized metal.
  - 3. Aluminum (not otherwise coated).
- C. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for surface preparation and the application of paint systems on metal surfaces.
  - 2. Division 05 Section "Metal Stairs" for surface preparation and the application of paint systems on metal fabricated stairs.
  - 3. Division 05 Section "Pipe and Tube Railings" for surface preparation and the application of paint systems on metal surfaces.
  - 4. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior surfaces.
  - 5. Division 07 Section "Exterior Insulating Finish System (EIFS)" for finishing EIFS systems.

#### 1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 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, with the proposed product highlighted.
3. VOC content.

## 1.5 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.
  - 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.

## 1.6 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 .

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

## 1.7 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

## 1.8 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 5 percent, but not less than 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 the following:
  1. Sherwin-Williams Company (The). (Basis of Design and paint systems)
  2. Benjamin Moore & Co.
  3. Porter Paints.
  4. PPG Architectural Finishes, Inc.

### 2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. 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.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range.
  1. Twenty-five (25) percent of surface area may be painted with deep tones.

### 2.3 BLOCK FILLERS

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

### 2.4 PRIMERS/SEALERS

- A. Primer, Alkali Resistant, Water Based: MPI #3.
- B. Sealer: Sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.

### 2.5 METAL PRIMERS

- A. Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.
- B. Primer, Galvanized: As recommended in writing by topcoat manufacturer.

### 2.6 WATER-BASED PAINTS

- A. Latex, Exterior Semi-Gloss (Gloss Level 3): MPI #11.

- B. Light Industrial Coating, Exterior, Water Based, Gloss (Gloss Level 6): MPI #164.

## 2.7 TEXTURED AND HIGH-BUILD COATINGS

- A. Primer for Textured Coating, Latex, Flat: As recommended in writing by topcoat manufacturer.
- B. Intermediate Coat for Textured Coating, Latex, Flat: As recommended in writing by topcoat manufacturer.
- C. Textured Coating, Latex, Flat: MPI #42.
- D. Primer for Latex, Exterior, High Build: As recommended in writing by topcoat manufacturer.
- E. Intermediate Coat for Latex, Exterior, High Build: As recommended in writing by topcoat manufacturer.
- F. Latex, Exterior, High Build: MPI #40.

## 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 (Clay and CMU): 12 percent.
  - 3. Wood: 15 percent.
  - 4. Portland Cement Plaster: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces 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 hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is 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.
  - 2. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3. 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.
4. Aluminum Substrates: Remove loose surface oxidation.

### 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  1. Unless specifically noted otherwise in the specific Specification Sections above, paint the following work where exposed to view: Where painting is covered in other Specification Sections, coordinate with Construction Manager / General Contractor for determination of which subcontractor is to provide coatings.
    - a. Equipment, including panelboards and switch gear.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Tanks that do not have factory-applied final finishes.

### 3.4 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.

### 3.5 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
  1. Latex System:
    - a. Prime Coat: Latex, exterior, matching topcoat.

- 1) SW-Loxon Concrete & Masonry Primer, A24W8300 Series
  - b. Intermediate Coat: Latex, exterior, matching topcoat.
    - 1) SW-Resilience Exterior Acrylic Latex, K43W00051.
  - c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.
    - 1) SW-Resilience Exterior Acrylic Latex, K43W00051.
- B. CMU and Cement Plaster Substrates:
1. Latex System:
    - a. Prime Coat: Block filler, latex, interior/exterior, MPI #4.
      - 1) SW-PrepRite Int/Ext. Block Filler, B25W25
    - b. Intermediate Coat: Latex, exterior, matching topcoat.
      - 1) SW-Resilience Exterior Acrylic Latex, K43W00051.
    - c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.
      - 1) SW-Resilience Exterior Acrylic Latex, K43W00051.
  2. Latex over Alkali-Resistant Primer System:
    - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
      - 1) SW-Loxon Concrete & Masonry Primer, A24W8300 Series
    - b. Intermediate Coat: Latex, exterior, matching topcoat.
      - 1) SW-Resilience Exterior Acrylic Latex, K43W00051.
    - c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.
      - 1) SW-Resilience Exterior Acrylic Latex, K43W00051.
- C. Aluminum Paint System MPI EXT 10.2D:
1. Prime Coat: Primer, rust inhibitive, water based, MPI #107.
  2. Intermediate Coat: Aluminum paint, matching topcoat.
  3. Topcoat: Aluminum paint, MPI #1
- D. Steel and Galvanized Metal Substrates:
1. Water-Based Coating System:
    - a. Prime Coat: Shop primer specified in Division 05 Section where substrate is specified.
    - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
      - 1) SW-Resilience Exterior Acrylic Latex, K43W00051
    - c. Topcoat: exterior, water based, semi-gloss (Gloss Level 5), MPI #163.
      - 1) SW-Resilience Exterior Acrylic Latex, K43W00051

END OF SECTION 09 91 13



## **SECTION 09 91 23 - INTERIOR PAINTING**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Provide preparation and paint system for all exposed and semi-exposed interior surfaces not factory finished or specified to be finished under individual specification Sections.
- B. This Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Galvanized metal (HM doors and frames).
  - 2. Gypsum board.
  - 3. Wood.
- C. Related Requirements:
  - 1. Division 05 Sections for shop priming of metal substrates.
  - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
  - 3. Division 08 Sections for factory priming steel doors with primers specified in this Section.
  - 4. Division 08 Sections for factory finishing wood doors.
  - 5. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

#### 1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches 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. VOC content.

#### 1.5 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. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

#### 1.6 QUALITY ASSURANCE

- A. 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.
    - b. Exposed-to-view structural surfaces: Provide samples of at least 100 sq. ft.
    - c. 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.
  4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 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 .
1. Maintain containers in clean condition, free of foreign materials and residue.
  2. Remove rags and waste from storage areas daily.

#### 1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

### 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 the following:
1. Sherwin-Williams Company (The). (Basis of Design and paint systems)
  2. Benjamin Moore & Co.
  3. Porter Paints.
  4. PPG Architectural Finishes, Inc.

## 2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. 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.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24). VOC content shall also meet requirements as noted above.
1. Flat Paints and Coatings: 50 g/L.
  2. Non-Flat Paints and Coatings: 150 g/L.
  3. Dry-Fog (Powder-Coat) Coatings: 400 g/L.
  4. Primers, Sealers, and Undercoaters: 200 g/L.
  5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
  6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  7. Pretreatment Wash Primers: 420 g/L.
  8. Floor Coatings: 100 g/L.
- D. Colors: As selected by Architect from manufacturer's full range.
1. Twenty-five (25) percent of surface area may be painted with deep tones.

## 2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4. SW-Loxon Acrylic Block Surfacer/Block Filler, LX01W0200.

## 2.4 PRIMERS/SEALERS

- A. Primer Sealer, Latex, Interior: MPI #50. SW-Premium Wall & Wood Interior latex Primer, B28W08111. May be used on factory primed metals.
- B. Primer, Alkali Resistant, Water Based: MPI #3. SW-Loxon Concrete & Masonry Primer, LX02W0050.

## 2.5 METAL PRIMERS

- A. Primer, Rust-Inhibitive, Water Based: MPI #107. SW-All Surface Enamel Acrylic Latex, A41W01210.

## 2.6 WATER-BASED PAINTS

- A. Latex, Interior, Pearl, (Gloss Level 5): MPI #54. SW-Cashmere Interior Acrylic Latex, SW-D15W00150 High Reflective White Base.
- B. Latex, Interior, Pearl, (Gloss Level 5): MPI #54. SW-Cashmere Interior Acrylic Latex, SW-D15W00153 Deep Base.
- C. Latex, Interior, Gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees): MPI #114. SW-Pro-Classic Waterborne Interior Acrylic Enamel, SW-B21W00051.

## 2.7 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
  - 1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
  - 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 prior to repainting with complying materials.

## 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. Wood: 15 percent.
  - 3. Gypsum Board: 12 percent.
  - 4. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces 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 hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is 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.

- 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. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
- G. 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 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.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- 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 Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Unless specifically noted otherwise in the specific Specification Sections above, paint the following work where exposed to view: Where painting is covered in other Specification Sections, coordinate with Construction Manager / General Contractor for determination of which subcontractor is to provide coatings.
    - a. Uninsulated metal piping.
    - b. Uninsulated plastic piping.
    - c. Uninsulated ductwork and equipment
    - d. Metal conduit.
    - e. Plastic conduit.
    - f. Tanks that do not have factory-applied final finishes.
    - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - h. Other items as directed by Architect.
  - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
  - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

### 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. Galvanized-Metal Substrates (factory primed):
  - 1. High Performance System – Semi-gloss
    - a. Prime Coat: **Macropoxy 646-100, B58 series**
    - b. Intermediate Coat: **High Solids Polyurethane Semi-Gloss, B65-630**
    - c. Topcoat: **High Solids Polyurethane Semi-Gloss, B65-630**
- B. Gypsum Board or Plaster Substrates:
  - 1. High Performance System - Eg-Shel:
    - a. Prime Coat: **ProMar 200 Zero VOC Primer, B28W2600**
    - b. Intermediate Coat: **Pro Industrial Waterbased Catalyzed Epoxy Gloss, B73-300 series**
    - c. Topcoat: **Pro Industrial Waterbased Catalyzed Epoxy Gloss, B73-300 series**
- C. Block/CMU Substrates:
  - 1. High Performance System - Gloss
    - a. Prime Coat: **Heavy Duty Block Filler, B42W46**
    - b. Intermediate Coat: **Pro Industrial Waterbased Catalyzed Epoxy Gloss, B73-300 series**
    - c. Topcoat: **Pro Industrial Waterbased Catalyzed Epoxy Gloss, B73-300 series**

END OF SECTION 09 91 23

## **SECTION 09 96 46 - INTUMESCENT PAINTING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Special Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes surface preparation and application of 1-hour fire rated fire-retardant intumescent paint to interior closed cell spray foam insulation items and surfaces.
- B. Related Requirements:
  - 1. Section 07 21 00 "Thermal Insulation" for fire-resistance-rated intumescent coating over spray foam insulation.

#### **1.3 PREINSTALLATION MEETINGS**

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

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Product List: Cross-reference to thermal insulation system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Material Test Reports: For each intumescent paint.

#### **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that are from same production run (batch mix) as materials applied and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Quantity: Furnish an additional 5 percent of each color applied, but not less than 1 gal. (3.8 L) of each material and color applied.

## 1.7 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated 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 coating system.
    - a. Thermal Insulation Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
  - 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.

## 1.8 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.

## 1.9 FIELD CONDITIONS

- A. Apply waterborne intumescent paints only when temperatures of surfaces to be painted and ambient air temperatures are between 50 and 90 deg F (10 and 32 deg C).
- B. Do not apply intumescent 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.
- C. Allow wet surfaces to dry thoroughly and to attain temperature and conditions specified before starting or continuing coating operation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide available products compatible with the substrates to be applied to.

### 2.2 INTUMESCENT PAINT MATERIALS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."



- B. Surface-Burning Characteristics of Fire-Retardant Systems: As tested according to ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.
  - 1. Flame-Spread Index: **25** or less.
  - 2. Smoke-Developed Index: **450** or less.
- C. Material Compatibility:
  - 1. Materials for use within each paint system shall be 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 material or coat, products and spreading rates shall be as recommended in writing by intumescent paint manufacturer for use on substrate indicated. Comply with requirements for fire-retardant coating classification and surface-burning characteristics indicated.
- D. Colors and Gloss: Any color and gloss.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with manufacturer's requirements for surface treatments, shop-primed surfaces, maximum moisture content, and other conditions affecting performance of the Work.
- B. Begin coating only when moisture content of wood substrate is 15 percent or less when measured with an electronic moisture meter.
- C. Begin coating no sooner than manufacturer recommended number of days after substrate is constructed and is visually dry on both sides.
- D. Verify suitability of substrates, including surface conditions, and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

#### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in the "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
  - 1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants. Do not coat surfaces if surface moisture content or alkalinity exceeds that permitted in manufacturer's written instructions.
  - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
  - 2. Perform cleaning and coating application so dust and other contaminants from cleaning process do not fall on wet, newly coated or existing finished surfaces.

### 3.3 APPLICATION

- A. General: Apply intumescent paints according to manufacturer's written instructions and to comply with requirements for listing and labeling for surface-burning characteristics specified.
  - 1. Use equipment and techniques best suited for substrate and type of material being applied.
  - 2. Coat surfaces behind movable items the same as similar exposed surfaces.
  - 3. Apply each coat separately according to manufacturer's written instructions.
- B. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces on finished surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades and finished surfaces to remain against damage from coating 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 coated surfaces.

END OF SECTION 09 96 46

## SECTION 10 14 23 - PANEL SIGNAGE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Interior Room-identification signs (provide one for each space unless shown otherwise on the Drawings).
  - 2. Interior directional and information Signs (See Drawings).

#### 1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

#### 1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel 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 others, and accessories.
  - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- 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.
- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
  - 1. Room-Identification Signs: Full-size Sample of each type.
  - 2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
  - 3. Exposed Accessories: Full-size Sample of each accessory type.
- E. Sign Schedule: Use same designations specified or indicated on Drawings and in the sign schedule.

1.6 INFORMATIONAL SUBMITTALS

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

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

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

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 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. Deterioration of embedded graphic image.
    - c. Separation or delamination of sheet materials and components.
  - 2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: 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 signs.

2.2 SIGNS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Vista System.(Basis of Design)
  - 2. Others meeting the specifications.
- B. Room-Identification, Directional and Informational Signs: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. See drawings for sizes and text and graphic areas.
2. Sign-Panel Perimeter: Finish edges smooth.
3. Frame: Entire perimeter to hold changeable sign panel.
  - a. Material Thickness: 1/8".
  - b. Finish and Color: Black frame.
  - c. Profile: Square
  - d. Corners: Rounded
4. Mounting: 1/4" Type 316 stainless steel tamper resistant screw with commercial grade expansion anchors to suit wall construction. 4-anchors per sign.
5. Text and Typeface: Accessible raised characters and Braille typeface as selected by Architect from manufacturer's full range and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.

### 2.3 PANEL-SIGN MATERIALS

- A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, (UV filtering).

### 2.4 ACCESSORIES

- A. Fasteners and Anchors: 1/4" Type 316 stainless steel tamper resistant screw with commercial grade expansion anchors to suit wall construction. 4-anchors per sign.

### 2.5 FABRICATION

- A. Signs with Changeable Message Capability (as shown on Drawings): Fabricate signs to allow insertion of changeable messages as follows:
  1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by Owner.
- B. For frame to hold changeable sign panel, fabricate frame similar to Room Identification Signs without burrs or constrictions that inhibit function
- C. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  1. Preassemble signs and assemblies in the shop to greatest extent possible. Clearly mark units for installation; apply markings in locations concealed from view after final assembly.

### 2.6 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

## 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 signage work.
- 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 anchor inserts are 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. Install signs so they do not protrude or obstruct according to the accessibility standard.
  - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard.

### 3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs 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 10 14 23

## **SECTION 10 28 00 - TOILET, BATH, AND CUSTODIAL ACCESSORIES**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Public-use washroom accessories.
  - 2. Under lavatory guards.
  - 3. Custodial accessories.
  - 4. Glass and polished stainless steel detention mirrors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
  - 1. Construction details and dimensions.
  - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Material and finish descriptions.
  - 4. Features that will be included for Project.
  - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated on Drawings.
  - 2. Identify products using designations indicated on Drawings.
- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2 provide products of same manufacturer unless otherwise approved by Architect.

#### 1.5 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. Coordinate the required blocking to properly anchor each item.
- C. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

## 1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 15 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- C. Stainless Steel Mounting Devices: ASTM A 666, Type 304.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of stainless steel.
- E. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- F. Detention Mirrors: Type 430 stainless steel, frameless with bright polished finish.
- G. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

### 2.2 PUBLIC-USE WASHROOM ACCESSORIES

- 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. A & J Washroom Accessories, Inc.
  - 2. American Specialties, Inc.
  - 3. Bobrick Washroom Equipment, Inc.
  - 4. Bradley Corporation.
  - 5. General Accessory Manufacturing Co. (GAMCO).
- B. Toilet Tissue (Roll) Dispenser:
  - 1. Single Jumbo-Roll Dispenser: Fabricate of stainless steel for mounting indicated below, size to store and dispense one 10-inch-diameter core tissue rolls. Spindle adapter to accommodate a 1-5/8" diameter core roll; convertible to 2-1/8" to 3" diameter core roll. Theft-resistant key locked door and heavy-duty one-piece spindle.
    - a. Mounting: Surface mounted, 16-gauge stainless steel mounting plate and concealed anchorage (Bobrick #B-2890).
- C. Liquid-Soap Dispenser:
  - 1. Liquid Soap Dispenser, Surface Mounted: Type-304, 22-gauge stainless steel with satin finish. Body is drawn, one-piece, seamless construction. Valve shall be operable with less than 5-pounds of force. Container equipped with clear acrylic refill-indicator window, a locked hinged stainless-steel lid for top filling. Capacity lot less than 40-fluid-ounces. Unit shall have concealed vandal-resistant mounting. (Bobrick #B-2111).
- D. Grab Bar:



1. Stainless Steel Type: Provide grab bars with wall thickness not less than 18 gauge and as follows:
    - a. Mounting and Anchor Plates: Concealed (with flange anchored by set-screws), manufacturer's standard flanges and anchorages. Configurations indicated on drawings. Provide 3-inch wide, 12-gauge steel anchor plate with tapped mounting holes for each grab bar (Bobrick Series B-6806).
    - b. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
    - c. Gripping Surfaces: Manufacturer's standard non-slip texture.
- E. Sanitary-Napkin Disposal Unit:
1. Partition-Mounted Dual Access Type: Fabricate of 22-gauge Type 304 stainless steel satin finished with seamless exposed walls, featuring two self-closing push-flap doors (serves two stalls), stainless steel piano hinged waste receptacle on one side. (Bradley #4721-15).
    - a. Capacity: 1.5-gallon.
    - b. Rough Dimensions: 10-3/4 inches wide x 15-1/8 inches high.
  2. Semi-Recessed Single Access Type: Fabricate of 22-gauge Type 304 stainless steel with seamless exposed walls, featuring a self-closing push-flap door, stainless steel waste receptacle. (Bradley #4722-10-15).
    - a. Capacity: 1.5-gallon.
    - b. Rough Dimensions: 10-3/4 inches wide x 15-1/8 inches high.
  3. Disposal Liners: Provide one box of 500 waxed paper waste/napkin disposal liners #P11-022.
- F. Mirror Unit:
1. ADA Stainless Steel Frame Tilt Mirror Units: Fabricate 18-gauge Type-304 stainless steel with bright polished mirror finish, with mitered corners, 1/4" return. Secure with six countersunk tamper-resistant, flat-head, hex-socket, stainless steel machine screws. Supply with security hex key.
    - a. Size: 24" x 36" (Bobrick #B-293 2436)
    - b. ADA Wall Frame: Tapers from 4-3/8" at top to 1-5/15" depth at bottom.
    - c. Operation: Designed to provide full visibility for wheelchair bound people.
  2. Detention Mirrors (in Holding Cells where shown on Drawings) - Stainless Steel Frameless Mirror Units: Fabricate 18-gauge Type-430 stainless steel with bright polished mirror finish, with rounded corners, 1/4" return. Secure with six countersunk tamper-resistant, flat-head, hex-socket, stainless steel machine screws. Supply with tempered glass mirror. Mount with bottom reflective edge no more than 40" above finish floor.
    - a. Size: 11-1/4" x 17-1/4" (Bobrick #B-942)
- G. Under Lavatory Guard:
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings. Supply one set for each lavatory.
  2. Material and Finish: Antimicrobial, molded-plastic, white.
  3. 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:
    - a. Plumberex Specialty Products, Inc.
    - b. TCI Products.

c. Truebro, Inc.

2.3 FABRICATION General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous stainless steel hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

A. 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, when tested according to method in 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 recommendations.

END OF SECTION 10 28 00

## **SECTION 10 44 13 - FIRE EXTINGUISHER CABINETS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary, and Special 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.

- B. Related Sections:

- 1. Division 10 Section "Signage" for directional signage to out-of-sight fire extinguishers and cabinets.
- 2. Division 10 Section "Fire Extinguishers."

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

- 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

- C. Samples for Initial Selection: For each type of fire protection cabinet indicated.

- D. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

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

#### 1.4 QUALITY ASSURANCE

- 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.

#### 1.5 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.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

### 2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fire End & Croker Corporation;.
    - b. J. L. Industries, Inc., a division of Activar Construction Products Group;.
    - c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;.
    - d. Larsen's Manufacturing Company;.
    - e. Modern Metal Products, Division of Technico Inc.;.
    - f. Moon-American;.
    - g. Potter Roemer LLC;.
    - h. Watrous Division, American Specialties, Inc.; Insert product name or designation.
- B. Cabinet Construction: 1-hour fire rated.
  - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Steel sheet.
- D. Semi-recessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.
  - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Cabinet Trim Material: Steel sheet.
- F. Door Material: steel sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Tempered glass.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  - 1. Provide projecting door pull and friction latch.
  - 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- 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. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate As required by authorities having jurisdiction.

- a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
  - 1) Location: Applied to cabinet door.
  - 2) Application Process: Silk-screened.
  - 3) Lettering Color: Black.
  - 4) Orientation: Vertical.

K. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
  - a. Exterior of cabinet, door, and trim except for those surfaces indicated to receive another finish.
  - b. Interior of cabinet and door.
2. Steel: Baked enamel or powder coat.

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 selected.
  1. Fabricate doorframes with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
  2. Miter and weld perimeter doorframes.
- 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 "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.

2.5 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with

coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils .

1. Color and Gloss: As selected by Architect from manufacturer's full range.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

#### 3.3 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.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
  1. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

#### 3.4 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 10 44 13

## SECTION 31 31 16 - TERMITE CONTROL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Soil treatment with termiticide.
- B. Related Sections:
  - 1. Section 061000 "Rough Carpentry" for wood preservative treatment by pressure process.
  - 2. Section 076200 "Sheet Metal Flashing and Trim" for custom-fabricated, metal termite shields.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of termite control product.
  - 1. Include the EPA-Registered Label for termiticide products.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For termite control products, from manufacturer.
- B. 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.
- C. Warranties: Sample of special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- B. Source Limitations: Obtain termite control products from single source from single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site.

#### 1.6 PROJECT CONDITIONS

- A. 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.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

- C. Install bait-station system [during construction to determine areas of termite activity] [and] [after construction, including landscaping, is completed].

#### 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. 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: Ten years from date of Substantial Completion.

#### 1.8 MAINTENANCE SERVICE

- A. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

### PART 2 - PRODUCTS

#### 2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Corporation, Agricultural Products; Termidor.
    - b. Bayer Environmental Science; Premise 75.
    - c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar or Prevail.
    - d. Syngenta; Demon TC, Prelude or Probuild TC.
  - 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than ten 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 requirements, 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: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all 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, complying with requirements of authorities having jurisdiction.

### 3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

### 3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
  - 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: Adjacent soil, including soil 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. Avoid soil washout around footings.
  - 3. Masonry: Treat voids.
  - 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 31 16

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**BAY COUNTY**  
SHERIFF'S OFFICE  
Sheriff Tommy Ford

**BID SET PROJECT MANUAL/SPECIFICATIONS**  
for the  
**BAY COUNTY JAIL**  
**SUBSTANCE ABUSE UNIT**  
**VOLUME TWO DIVISIONS 15 - 33**  
Panama City, Florida  
April 19<sup>th</sup>, 2024



**Architect:**  
Florida Architects, Inc.  
103 W. 5<sup>th</sup> Street  
Panama City, FL 32401  
Ph: 850.257.5400



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## SECTION 21 13 00 - BUILDING SPRINKLER SYSTEMS

### 1 GENERAL

- 1.1 Drawings and General provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Requirements and Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of fire protection work is indicated on drawings and schedules, and by requirements of this section.
- 1.4 Refer to Division-2 sections for site fire protection piping and appurtenances; not work of this section.
- 1.5 Refer to other Division-21 sections for site fire protection piping and appurtenances; not work of this section.
- 1.6 Refer to Division-9 sections for painting of fire protection piping; not work of this section.
- 1.7 Refer to Division-26 sections for the following work; not work of this section.
  - 1.7.1 Fire alarm connections for all flow switches, pressure switches, and supervisory (tamper) switches.
- 1.8 Codes and Standards:
  - 1.8.1 NFPA Compliance: Install fire protection systems in accordance with NFPA 13 "Standard for the Installation of Sprinkler Systems"
  - 1.8.2 UL Compliance: Provide fire protection products in accordance with UL standards; provide UL label on each product.
  - 1.8.3 Fire Department/Marshal Compliance: Install fire protection systems in accordance with local regulations of fire department or fire marshal.
  - 1.8.4 Screw Thread Connections: Comply with local Fire Department/Fire Marshal regulations for sizes, threading and arrangement of connections for fire department equipment to sprinkler systems.
- 1.9 Approval Submittals:
  - 1.9.1 Product Data: Submit manufacturer's technical product data and installation instructions for:
    - Pipe and fittings
    - Basic pipe supports and hangers
    - Basic valves
    - Special valves
    - Pressure gauges
    - Automatic sprinklers
    - Cabinets
  - 1.10.2 Working (Shop) Drawings: Prepare working (shop) drawings of fire protection systems indicating



pipe sizes, pipe locations, pipe elevations, fittings, shutoffs, hangers, equipment, and coordination with other building systems. Submittal shall show all requirements per NFPA-13.

1.11 Test Reports and Verification Submittals:

1.11.1 Certificate: Submit certificate of Aboveground Installation upon completion of fire protection piping work which indicates that work has been tested in accordance with NFPA 13 and that system is operational, complete, and has no defects.

1.11.2 Tag: Submit a copy of the sprinkler system tag. The installing fire sprinkler contractor shall be licensed in accordance with State Fire Marshal (SFM) Rule 4A-46. At the conclusion of the project and prior to the final inspection by the SFM the Contractor shall tag the fire sprinkler system in accordance with 4A-46.041.

1.12 O&M Data Submittals:

1.12.1 Record Drawings: At project closeout, submit record drawings of installed fire protection piping and products.

1.12.2 Maintenance Data: Submit a copy of all approval submittals. Submit maintenance data and parts lists for basic valves, special valves, air compressors and exhausters. Include these data in O&M manual.

1.12.3 NFPA 25: Provide a copy of NFPA 25 in each O&M Manual.

2 PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in fire protection systems. Where more than one type of material or products are indicated, selection is Installer's option.

2.2 Basic Identification: Provide identification complying with Division-23 Basic Mechanical Materials and Methods section "Mechanical Identification", in accordance with the following listing:

Fire Protection Piping: Plastic pipe markers. Fire protection piping exposed to view shall be painted red.

Fire Protection Valves: Plastic or brass valve tags

Fire Protection Signs: Provide the following signs:

At each sprinkler valve, sign indicating what portion of system valve controls and hydraulic design data.

At each auxiliary drain, a sign indicating location.

2.3 Basic Pipes and Pipe Fittings: Provide pipes and pipe fittings complying with Division-23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings", in accordance with the

following listing. Where multiple listings are made for a particular type system, the material is the Installer's option.

2.4 Wet Pipe: Seamless black steel pipe; Schedule 40 for less than 8"; Schedule 30 for 8" and larger. Fittings and joints shall be as follows.

- 1 Class 125, cast-iron threaded fittings with threaded joints.
- 2 Mechanical grooved pipe coupling and fittings; cut-groove type with mechanical joints.
- 3 Wrought steel buttwelding fittings with welded joints.

2.4.1 Wet Pipe: Seamless black steel pipe; Schedule 10 for 5" and smaller; 0.134" wall thickness for 6"; and 0.188" wall thickness for 8" and 10".

- 1 Class 125, cast-iron threaded fittings with threaded joints, sizes 2½" and larger.
- 2 Mechanical grooved pipe couplings and fittings; roll-groove or mechanical locking type with mechanical joints.
- 3 Wrought steel buttwelding fittings with welded joints.

2.5 Basic Piping Specialties: Provide piping specialties complying with Division-23 Basic Mechanical Materials and Methods section "Piping Specialties".

2.6 Basic Supports and Anchors: Provide supports and anchors complying with Division-23 Basic Mechanical Materials and Methods section "Supports and Anchors", in accordance with the following listing:

Adjustable steel clevis hangers or adjustable steel band hangers for horizontal-piping hangers and supports.

Two-bolt riser clamps for vertical piping supports.

Steel turnbuckles and malleable iron sockets for hanger-rod attachments.

Concrete inserts, top-beam C-clamps, side beam or channel clamps or center beam clamps for building attachments.

2.7 Basic Valves: Provide interior valves complying with Division-23 Basic Mechanical Materials and Methods section "Valves", in accordance with the following listing:

2.7.1 Standard Service Code-Required OS&Y Valves: GA-6, GA-7.

2.7.2 Standard Service Sectional Valves: GA-6, GA-7. BF-6, BF-7.

2.7.3 Standard Service Indicating Valves: GA-6, GA-7, BA-6.

2.7.4 Standard Service Trim Valves: GA-6, BA-4.

2.7.5 Standard Service Check Valves: CK-4, CK-5.

2.8 Special Valves:

2.8.1 General: Provide valves, UL listed, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.

2.8.2 Alarm Check Valve: Provide cast-iron water flow alarm check valve, 175 psi working pressure, with retard chamber.

2.8.3 Hose Outlet Valves: Provide angle hose valves, 2-1/2" size where not otherwise indicated. Provide chrome plated with escutcheons where mounted in cabinet. Provide chain and cap.

2.8.4 Ball Drip Check Valve: Provide fire department connection iron swing check valve, 175 psi rated working pressure, of size and end type indicated, with ball drip.

2.8.5 Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the following:

Grinnell Fire Protection Systems Co., Inc.  
Grunau Sprinkler Mfr. Co., Inc.  
Reliable  
Viking Corporation

2.9 Basic Meters and Gauges: Provide meters and gauges complying with Division-23 Basic Mechanical Materials and Methods section "Meters and Gauges", in accordance with the following listing:

2.9.1 Pressure gauges, 0-250 psi range.

2.10 Fire Protection Specialties: Provide fire protection specialties, UL listed, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.

2.10.1 Water Flow Indicators: Provide vane type water flow switches, with adjustable retard.

2.10.2 Supervisory Switches: Provide products recommended by manufacturer for use in service indicated.

2.10.3 Acceptable Manufacturers: Subject to compliance with requirements, provide fire protection specialties of one of the following:

Grinnell Fire Protection Systems Co., Inc.  
Grunau Sprinkler Mfr. Co., Inc.  
Guardian Fire Equipment, Inc.  
Potter Roemer, Inc.  
Reliable  
Viking Corporation

2.11 Automatic Sprinklers: Provide automatic sprinklers and escutcheons of type indicated on drawings, and in accordance with the following listing. Provide quick response type automatic sprinklers. Provide fusible links for 165°F unless otherwise indicated.

2.11.1 Sprinkler Types

Upright.  
Pendant.  
Concealed pendent.

2.11.2 Finish: chrome-plated for concealed heads in occupied areas. Chrome-plated for pendant heads in exposed occupied areas. Cast brass for unoccupied areas.

2.11.3 Sprinkler Cabinet and Wrench: Furnish steel, baked red enameled, sprinkler box with capacity to store 10 sprinklers and wrench sized to sprinklers.

2.11.4 Acceptable Manufacturers: Subject to compliance with requirements, provide automatic sprinklers of one of the following:

Central Sprinkler Corp.  
Grinnell Fire Protection Systems Co., Inc.  
Star Sprinkler Mfg. Co. Inc.  
Reliable  
Viking Corp.  
Tyco

### 3 EXECUTION

3.1 General: Examine areas and conditions under which fire protection materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer. Any installation, modification, or alteration of the sprinkler system shall be performed only by a person under a certificate of competency issued by the State Fire Marshal.

3.2 Installation of Basic Identification: Install mechanical identification in accordance with Division-23 Basic Mechanical Materials and Methods section "Mechanical Identification." Install fire protection signs on piping in accordance with NFPA 13 requirements. Continuously paint exposed fire piping red in mechanical and electrical rooms.

#### 3.3 Installation of Pipes and Pipe Fittings:

3.3.1 General: Install pipes and pipe fittings in accordance with Division-23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings."

3.3.2 Comply with requirements of NFPA 13 for installation of fire protection piping materials. Install piping products where indicated, in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that piping systems comply with requirements and serve intended purposes.

3.3.3 Coordinate with other work as necessary to interface components of fire protection piping properly with other work.

3.3.4 Install drain piping at low points of piping system. Provide dry drum drips where indicated.

3.3.5 Install sectional valves in inlet piping, at bottom of each riser, and in loops as indicated.

3.3.6 Install water flow indicators where indicated.

- 3.3.7 Mount supervisory switches on each sectional valve.
- 3.3.8 Install pressure gauges where required and at top of each standpipe.
- 3.3.9 Install manual shutoff at each audible alarm station.
- 3.3.10 Install valved hose connections of sizes indicated, or ¾" size if not otherwise indicated, on sprinkler at ends of branch lines and cross mains and at locations where indicated. The intent is to meet the requirements of NFPA 13 and to achieve a fully drainable system.
- 3.3.13 Install Inspector's test connection where indicated, or at most remote point from riser.
- 3.4 Installation of Piping Specialties: Install piping specialties in accordance with Division-23 Basic Mechanical Materials and Methods section "Piping Specialties."
- 3.5 Installation of Supports and Anchors: Install supports and anchors, in accordance with Division-23 Basic Mechanical Materials and Methods section, "Supports and Anchors."
- 3.6 Installation of Valves: Install valves in accordance with Division-23 Basic Materials and Methods section "Valves." Provide valves to isolate each riser and elsewhere as required by NFPA 13 .
- 3.7 Installation of Meters and Gauges: Install meters and gauges in accordance with Division-23 Basic Mechanical Materials and Methods section "Meters and Gauges."
- 3.8 Installation of Fire Protection Specialties: Install fire protection specialties as indicated, and in accordance with NFPA 13. Furnish wiring requirements to electrical Installer for electrical wiring of supervisory switches.
- 3.9 Field Quality Control:
  - 3.9.1 Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush feed mains, lead-in connections and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system, as required to remove foreign substances, under pressure as specified in NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.
  - 3.9.2 Hydrostatic Testing: After flushing system, test fire sprinkler piping hydrostatically, for period of 24 hours, at not less than 200 psi or at 50 psi in excess of maximum static pressure when maximum static pressure is in excess of 150 psi. Check system for leakage of joints. Measure hydrostatic pressure at low point of each system or zone being tested.
  - 3.9.3 Repair or replace piping system as required to eliminate leakage in accordance with NFPA standards for "little or no leakage" and retest as specified to demonstrate compliance.
- 3.10 Cleaning and Inspecting: Clean and inspect fire protection systems in accordance with requirements of Division-23 Basic Mechanical Materials and Methods section "Testing, Cleaning, and Sterilization of Piping Systems".
- 3.11 Extra Stock:

- 3.11.1 Heads: For each style and temperature range required, furnish additional sprinkler heads, amounting to one unit for every 100 installed units, but not less than 5 units of each.
- 3.11.2 Wrenches: Furnish 2 spanner wrenches for each type and size of valve connection and fire hose coupling. Obtain receipt from Owner that extra stock has been received.
- 3.12 Owner Instruction: Provide technical services for one 4-hour period to instruct Owner's personnel in operation and maintenance of building sprinkler systems. Schedule training date with Owner. Provide at least 7-day notice to Engineer and Owner of training date.

END OF SECTION 21 13 00

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## SECTION 22 01 00 - PLUMBING GENERAL

### 1 GENERAL

- 1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the plumbing work as herein called for and shown on the drawings.
- 1.2 Related Documents:
- 1.2.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- 1.2.2 This is a Basic Plumbing Requirements Section. Provisions of this section apply to work of all Division-22 sections. Provisions of Division-23 Basic Mechanical Requirements Sections apply to work of all Division-22 sections.
- 1.2.3 Review all other contract documents to be aware of conditions affecting work herein.
- 1.2.4 Definitions:
- 1.2.4.1 Provide: Furnish and install, complete and ready for intended use.
- 1.2.4.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.
- 1.2.4.3 Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- 1.3 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for his work and pay all fees and charges incidental thereto.
- 1.4 Verification of Owner's Data: Prior to commencing any work the Contractor shall satisfy himself as to the accuracy of all data as indicated in these plans and specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Architect/Engineer in order that proper adjustments can be anticipated and ordered. Commencement by the Contractor of any work shall be held as an acceptance of the data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions or inaccuracies of the said data.
- 1.5 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and accidental damage.
- 1.6 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be constructed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.
- 1.7 Field Measurements and Coordination:
- 1.7.1 The intent of the drawings and specifications is to obtain a complete and satisfactory installation. Separate divisional drawings and specifications shall not relieve the Contractor or subcontractors from full compliance of work of his trade indicated on any of the drawings or in any section of the specifications.



- 1.7.2 Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.
- 1.7.3 Coordinate work in this division with all other trades in proper sequence to insure that the total work is completed within contract time schedule and with a minimum cutting and patching.
- 1.7.4 Locate all apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on plumbing drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.
- 1.7.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval.
- 1.7.6 Carefully examine any existing conditions, piping, and premises. Compare drawings with existing conditions. Report any observed discrepancies. It shall be the Contractor's responsibility to properly coordinate the work and to identify problems in a timely manner. Written instructions will be issued to resolve discrepancies.
- 1.7.7 Because of the small scale of the drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate piping, ductwork, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and for coordination with all trades. Contractor shall not order materials or perform work without such verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or piping cannot be fitted, the Architect/Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.
- 1.8 Guarantee:
- 1.8.1 The Contractor shall guarantee labor, materials and equipment for a period of one (1) year from Final Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.
- 1.8.2 Owner reserves right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving Contractor of his responsibilities during guarantee period.
- 1.9 Approval Submittals:
- 1.9.1 When approved, the submittal control log and submittals shall be an addition to the specifications herewith, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.
- 1.9.1.1 Shop drawings, product literature, and other approval submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following.
- 1.9.1.1.1 Submittals shall be properly organized in accordance with the approved submittal control log.
- 1.9.1.1.2 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.

- 1.9.1.1.3 Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control number, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approval stamps. A sample cover sheet is included at the end of this section.
- 1.9.1.1.4 Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the cover sheet.
- 1.9.1.1.5 Submittals that include a series of fixtures or devices (such as plumbing fixtures or valves) shall be organized by the fixture number or valve type and be marked accordingly. Each fixture must include all items associated with that fixture regardless of whether or not those items are used on other fixtures.
- 1.9.1.1.6 The electrical design shown on the drawings supports the plumbing equipment basis of design specifications at the time of design. If plumbing equipment is submitted with different electrical requirements, it is the responsibility of the plumbing contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the plumbing submittal with a written statement that this change will be provided at no additional cost. Plumbing submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.
- 1.9.2 If the shop drawings show variation from the requirements of contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in writing in his letter of transmittal and on the submittal cover sheet in order that, if acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.
- 1.9.3 Review of shop drawings, product literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer each such deviation in writing at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, product literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.
- 1.9.4 Submit shop drawings as called for in other sections after award of the contract and before any material is ordered or fabricated. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than ¼" per foot), with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.
- 1.10 Test Reports and Verification Submittals: Submit test reports, certifications and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, submit the reports, review the reports and take corrective action within the scheduled contract time.
- 1.11 O&M Data Submittals: Submit Operation and Maintenance data as called for in other sections. When a copy of approval submittals is included in the O&M Manual, only the final "Approved" or "Approved as Noted" copy shall be used. Contractor shall organize these data in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit manuals at the Substantial Completion inspection.

## 2 PRODUCTS

- 2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them at the building and shall be

of reputable manufacturers. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.

2.2 Equipment and Materials:

2.2.1 Shall be new and the most suitable grade for the purpose intended. Equipment furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar units or equipment.

2.2.2 Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.

2.2.3 The label of the approving agency, such as UL, IBR, ASME, ARI, AMCA, by which a standard has been established for the particular item shall be in full view.

2.2.4 The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer's latest design.

2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

2.2.7 Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material and type of construction desired. Manufacturer's products shown on the drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products, or the particular products of named manufacturers, meet the detailed specifications and that size and arrangement of equipment are suitable for installation.

2.2.8 Model Numbers: Catalog numbers and model numbers indicated in the drawings and specifications are used as a guide in the selection of the equipment and are only listed for the contractor's convenience. The contractor shall determine the actual model numbers for ordering materials in accordance with the written description of each item and with the intent of the drawings and specifications.

2.3 Requests for Substitution:

2.3.1 Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product or material specified.

2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

2.3.2.1 Required product cannot be supplied in time for compliance with Contract time requirements.

2.3.2.2 Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disability as certified by Contractor.

2.3.2.3 Substantial cost advantage is offered Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.

- 2.3.3 All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products:

Principal of operation.  
Materials of construction or finishes.  
Thickness of gauge of materials.  
Weight of item.  
Deleted features or items.  
Added features or items.  
Changes in other work caused by the substitution.  
Performance curves.

If the approved substitution contains differences or omissions not specifically called to the attention of the Architect/Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products (or to have the substituted products replaced) at the Contractor's expense.

### 3 EXECUTION

- 3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.

#### 3.2 Coordination:

- 3.2.1 The Contractor shall be responsible for full coordination of the plumbing systems with shop drawings of the building construction so the proper openings and sleeves or supports are provided for piping, ductwork, or other equipment passing through slabs or walls.

- 3.2.2 Any additional steel supports required for the installation of any plumbing equipment, piping, or ductwork shall be furnished and installed under the section of the specifications requiring the additional supports.

- 3.2.3 It shall be the Contractor's responsibility to see that all equipment such as valves, dampers, filters and such other apparatus or equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the drawings.

- 3.2.4 All connections to fixtures and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.

- 3.2.5 The contractor shall protect equipment, material, and fixtures at all times. He shall replace all equipment, material, and fixtures which are damaged as a result of inadequate protection.

- 3.2.6 Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.

- 3.2.7 Start of work will be construed as acceptance of suitability of work of others.

- 3.3 Interruption of Service: Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.

- 3.4 Phasing: Provide all required temporary valves, piping, ductwork, equipment and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.
- 3.5 Cutting and Patching: Notify General Contractor to do all cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under this section. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.
- 3.6 Equipment Setting: Bolt equipment directly to concrete pads or vibration isolators as required, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.
- 3.7 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 22. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.
- 3.8 Clean-up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, contractor is to carefully clean up and leave premises and all portions of building free from debris and in a clean and safe condition.
- 3.9 Start-up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, start-up shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in start-up check.
- 3.10 Record Drawings:
- 3.10.1 During the progress of the work the Contractor shall record on their field set of drawings the exact location, as installed, of all piping, ductwork, equipment, and other systems which are not installed exactly as shown on the contract drawings.
- 3.10.2 Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 sections.
- 3.11 Acceptance:
- 3.11.1 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.
- 3.11.2 Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with project, for one day to instruct permanent operating personnel in operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.
- 3.11.3 Operation and Maintenance Manuals: Furnish four complete manuals bound in ring binders with Table of Contents, organized, and tabbed by specification section. Manuals shall contain:
- Detailed operating instructions and instructions for making minor adjustments.
  - Complete wiring and control diagrams.
  - Routine maintenance operations.
  - Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
  - Copies of approved submittals.
  - Copies of all manufacturer's warranties.

Copies of test reports and verification submittals.

3.11.4 Record Drawings: Submit record drawings.

END OF SECTION 22 01 00

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## SECTION 22 07 00 - INSULATION FOR PLUMBING EQUIPMENT AND PIPING

### 1 GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 Division-22 Basic Plumbing Materials and Methods Sections apply to work of this section.

1.3 Approval Submittals:

1.3.1 Product Data: Submit a producer's data sheets and installation instructions on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:

1.3.1.1 Fiberglass pipe insulation

1.3.1.2 Flexible unicellular piping insulation

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

### 2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Armstrong, Johns Manville, Knauf, Owens Corning, Pittsburgh Corning, U.S. Rubber, or approved equal. All products shall be asbestos-free.

2.2 Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesive) with a flame-spread rating of 25 or less, and a smoke-developed rating of 50 or less, as tested by ANSI/ASTM E84.

2.3 Pipe Insulation Materials:

2.3.1 Fiberglass Pipe Insulation: ASTM C547, Class 1 unless otherwise indicated. (Preformed sleeving with white all-service jacket, suitable for temperatures up to 450°F)

2.3.2 Cellular Glass Pipe Insulation: ASTM C552, Type II, Class 1. (Uncovered.)

2.3.3 Flexible Unicellular Pipe Insulation: ASTM C534, Type I. (Tubular, suitable for use to 200°F.)

2.3.4 Staples, Bands, Wires, and Cement: As recommended by the insulation manufacturer for applications indicated.

2.3.5 Adhesives, Sealers, Protective Finishes: Products recommended by the insulation manufacturer for the application indicated.

2.3.6 Jackets: ASTM C921, Type I (vapor barrier) for piping below ambient temperature, Type II (vapor permeable) for piping above ambient temperature. Type I may be used for all piping at Installer's option.

### 3 EXECUTION

3.1 General:

3.1.1 Install thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.



- 3.1.2 Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- 3.1.3 Maintain integrity of vapor-barrier on insulation and protect it to prevent puncture and other damage. Label all insulation "ASBESTOS FREE".
- 3.1.4 Do not apply insulation to surfaces while they are hot or wet.
- 3.1.5 Do not install insulation until systems have been checked and found free of leaks. Surfaces shall be clean and dry before attempting to apply insulation. A professional insulator with adequate experience and ability shall install insulation.
- 3.1.6 Do not install insulation on pipe systems until acceptance tests have been completed except for flexible unicellular insulation. Do not install insulation until the building is "dried-in".
- 3.2 Fiberglass Pipe Insulation:
  - 3.2.1 Insulate the following piping systems (indoor locations):
    - 3.2.1.1 Domestic hot water, 105°-140° F: up to 3" pipe - 1½" thick, over 3" pipe - 2" thick.
  - 3.2.2 Apply insulation to pipe with all side and end joints butted tightly. Seal longitudinal lap by pressurizing with plastic sealing tool. Apply 3 inch wide self sealing butt strips to joints between insulation sections. Insulate all fittings, flanges, valves and strainers with premolded insulation. Apply coat of insulating cement to fittings and wrap with glass cloth overlapping each wrap 1" and adjacent pipe 2". Finish with heavy coat of general purpose mastic. Premolded PVC covers may also be used, but no flexible inserts are allowed.
  - 3.2.3 Provide hanger or pipe support shields of 16 gauge (minimum) galvanized steel over the insulation which extends halfway up the pipe insulation cover and at least 6" on each side of the hanger.
  - 3.2.4 Omit insulation on exposed plumbing fixture runouts from faces of wall or floor to fixture; on unions, flanges, strainer blowoffs, flexible connections and expansion joints.
- 3.3 Flexible Unicellular Pipe Insulation:
  - 3.3.1 Insulate the following piping systems:
    - 3.3.1.1 Storm water piping above ceilings including roof drain body – 3/4" thick.
  - 3.3.2 Apply insulation in accordance with the manufacturer's recommendations and instructions. Mitre cut insulation to fit pipe fittings. Use approved cement to seal all joints and ends in the insulation.

**END OF SECTION 22 07 00**

## SECTION 22 11 13 - POTABLE WATER SYSTEM

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-22 Basic Plumbing Requirements and Basic Plumbing Materials and Methods sections apply to work of this section.
- 1.3 Division-23 Basic Mechanical Materials and Methods Sections apply to work of this section.
- 1.4 Extent of potable water systems work, is indicated on drawings and schedules, and by requirements of this section.
- 1.5 Refer to other Division-22 sections for site water distribution system; not work of this section unless noted.
- 1.6 Refer to appropriate Division-2 sections for exterior potable water system; not work of this section unless noted.
- 1.7 Insulation for potable water piping is specified in other Division-22 sections, and is included as work of this section. Insulation requirements include:
  - 1.7.1 Domestic hot water piping
- 1.8 Excavation and backfill required in conjunction with water piping is specified in other Division-23 sections, and is included as work of this section.
- 1.9 Code Compliance: Comply with applicable portions of Florida Building Code-Plumbing pertaining to selection and installation of plumbing materials and products. Comply with local utility requirements.
- 1.10 Approval Submittals:
  - 1.10.1 Product Data: Submit manufacturer's technical product data and installation instructions for:
    - Valves
    - Strainers
    - Wall hydrants
    - Water hammer arresters
    - Meters and gauges
    - Relief valves
    - Trap primers
  - 1.11 Test Reports and Verification Submittals:
    - 1.11.1 Disinfection: Submit report by Health Department.
- 1.12 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts lists for valves, trap primers. Include these data in O&M manual.

### 2 PRODUCTS

- 2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with Florida Building Code-Plumbing where applicable. Provide sizes and types

- matching pipe materials used in potable water systems. Where more than one type of materials or products is indicated, selection is Installer's option.
- 2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following listed for each item.
- 2.3 Identification: Provide identification complying with Division-23 Basic Mechanical Materials and Methods section "Mechanical Identification". Provide manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct burial service; not less than 6" wide x 4 mils thick. Provide blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW".
- 2.4 Pipes and Fittings: Provide pipes and pipe fittings complying with Division-23 Basic Plumbing Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:
- 2.4.1 Interior Water Piping:
- 2.4.1.1 Above Grade: Copper tube; Type L, hard-drawn temper; wrought-copper fittings, solder-joints.
- 2.4.1.2 Below Grade: Copper tube; Type L, soft-annealed temper; no joints below floor.
- 2.4.2 Exterior Water Piping:
- 2.4.2.1 Copper tube; Type L, hard-drawn temper; wrought-copper fittings, solder-joints.
- 2.4.3 Solder joints shall be made with 95-5 solder.
- 2.5 Piping Specialties: Provide piping specialties complying with Division-22 Basic Plumbing Materials and Methods section "Piping Specialties".
- 2.6 Supports and Anchors: Provide supports and anchors complying with Division-22 Basic Plumbing Materials and Methods section "Supports and Anchors".
- 2.7 Interior Valves: Provide valves complying with Division-22 Basic Plumbing Materials and Methods section "Valves", in accordance with the following listing:
- 2.7.1 Sectional and Shutoff Valves: GA1, GA2, GA3, BA1, BA2.
- 2.7.2 Drain Valves: GA1, GA2, BA1, BA2.
- 2.7.3 Throttling Valves: BA1, BA2.
- 2.7.4 Check Valves: CK1, CK2, CK3.
- 2.8 Wall Hydrants: Provide complete bronze body hose bibbs inside stainless steel box with hinged access door with cylinder lock and "WATER" stamped on cover. Provide key operated control valve with all bronze interior parts, replaceable seat washer, screwdriver operated stop valve in supply, and 3/4" male threaded hose connection. Zurn Z1350 or equal by Acorn or Woodford.
- 2.9 Water Hammer Arresters: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201. Precision Plumbing Products, Josam, Zurn, Amtrol, Wade, Jay R. Smith, or approved equal.
- 2.10 Meters and Gauges: Provide meters and gauges complying with Division-22 Basic Plumbing Materials and Methods section "Meters and Gauges", in accordance with the following listing:

Thermometers

Pressure gauges  
Calibrated balancing cocks

- 2.11 Combined Pressure-Temperature Relief Valves: Provide relief valves as indicated, of size and capacity as selected by Installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code. Provide bronze body, test lever and thermostat complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210°F, and pressure relief at 150 psi. Watts, Cash, Zurn, or approved equal.
- 2.12 Trap Primers: Provide electronic trap primer in NEMA 1, UL 50 12x12x4 16 gauge steel cabinet with hinged access door. Entire cabinet to be coated with ANSI 61 gray polyester powder paint. Electronic trap primer shall cycle open for 6 seconds every 24 hours and provide a minimum of 2 oz at 20 psi for every drain served. 120v/1 phase. Provide distribution block to serve up to 4 floor drains.

### 3 EXECUTION

- 3.1 General: Examine areas and conditions under which potable water systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- 3.2 Install plumbing identification in accordance with Division-23 Basic Mechanical Materials and Methods section "Mechanical Identification". Install underground plastic pipe markers during backfill, 6"-8" below grade.
- 3.3 Install water distribution piping in accordance with Division-23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".
- 3.3.1 Install piping with 1/32" per foot (¼%) downward slope towards drain point.
- 3.3.2 Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- 3.4 Install exterior water piping in compliance with local governing regulations. Water piping shall be installed with a minimum of 30 inches of cover unless otherwise indicated.
- 3.5 Install piping specialties in accordance with Division-23 Basic Mechanical Materials and Methods section "Piping Specialties".
- 3.6 Install supports and anchors in accordance with Division-23 Basic Mechanical Materials and Methods section "Supports and Anchors".
- 3.7 Install valves in accordance with Division-23 Basic Mechanical Materials and Methods section "Valves".
- 3.7.1 Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.
- 3.7.2 Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
- 3.7.3 Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain potable water system.
- 3.7.4 Check Valves: Install where indicated.
- 3.8 Hose Bibbs and Wall Hydrants: Install on concealed piping where indicated with vacuum breaker.

Mount 18 inches above grade or finished floor.

- 3.9 Install meters and gauges in accordance with Division-23 Basic Mechanical Materials and Methods section "Meters and Gauges".
- 3.10 Install relief valves on each water heater, and where indicated in accordance with the manufacturer's instructions. Pipe full size outside or to floor drain. Cut the end of the pipe at a 45° angle and terminate 6 inches above the floor or grade.
- 3.11 Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Florida Building Code-Plumbing.
- 3.12 Plumbing Equipment Connections: Connect hot and cold water piping system to plumbing equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.
- 3.13 Install water hammer arresters in upright position, in locations and of sizes indicated in accordance with PDI Standard WH-201.
- 3.14 Install trap primers as indicated, and in accordance with manufacturer's installation instructions. Provide access panels to all trap primers unless accessible through a lay-in ceiling or inside mechanical room.
- 3.15 Locate all valves and devices requiring access above lay-in ceiling.
- 3.16 Piping Tests: Test, clean, and sterilize potable water piping in accordance with testing requirements of Division-23 Basic Mechanical Materials and Methods section "Testing, Cleaning, and Sterilization of Piping Systems".

END OF SECTION 22 11 13

## SECTION 22 13 16 - SOIL, WASTE AND VENT SYSTEM

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-22 Basic Plumbing Requirements and Basic Plumbing Materials and Methods sections apply to work of this section.
- 1.3 Division-23 Basic Mechanical Materials and Methods Sections apply to work of this section.
- 1.4 Extent of soil waste and vent systems work is indicated on drawings and schedules, and by requirements of this section.
- 1.5 Refer to appropriate Division-2 sections for exterior sanitary sewer system required in conjunction with soil and waste systems; not work of this section.
- 1.6 Excavation and backfill required in conjunction with soil, waste and vent piping is specified in other Division-23 sections and is included as work of this section.
- 1.7 Refer to Division-7 section "Flashing and Sheet Metal" for flashings required in conjunction with soil and waste systems; not work of this section.
- 1.8 Code Compliance: Comply with applicable portions of Florida Building Code-Plumbing pertaining to plumbing materials, construction and installation of products. Comply with local utility requirements.
- 1.9 Approval Submittals:
- 1.9.1 Product Data: Submit manufacturer's technical product data for:

Cleanouts  
Floor drains

### 2 PRODUCTS

- 2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste systems. Where more than one type of materials or products is indicated, selection is Installer's option.  
  
Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide green tape with black printing reading "CAUTION SEWER LINE BURIED BELOW".
- 2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following listed for each item.
- 2.3 Pipes and Fittings: Provide pipes and pipe fittings complying with Division-23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:
  - 2.3.1 Above Ground Soil, Waste, and Vent Piping:
    - 2.3.1.1 Polyvinyl chloride plastic pipe (PVC); Type DWV; PVC plastic type DWV socket-type fitting, solvent cement joints. Do not use in fire-rated assemblies or return air plenums.

2.3.2 Underground Building Drain Piping (within 5 feet of the building):

2.3.2.1 Pipe Size 6" and Smaller: Polyvinyl chloride sewer pipe (PVC); Type DWV; PVC plastic type DWV socket-type.

2.4 Pipe Specialties: Provide piping specialties complying with Division-23 Basic Mechanical Materials and Methods section "Piping Specialties".

2.5 Supports and Anchors: Provide supports and anchors complying with Division-23 Basic Mechanical Materials and Methods section "Supports and Anchors".

2.6 Cleanouts: Provide factory-fabricated drainage piping products of size and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations. Josam, Jay R. Smith, Wade, Zurn.

2.6.1 Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1 countersunk head.

2.6.2 Cleanout for PVC Systems:

2.6.2.1 Floor Cleanouts: Cast-iron body with adjustable head, brass plug, and scoriated nick-brass cover. Furnish with carpet flange for carpeted floors. Furnish with recessed cover for tile floors. Furnish with clamping ring for floors with membrane. Wade W-6030 hub outlet for push-on.

2.6.2.2 Cleanouts in Piping: PVC cleanout adaptor with threaded PVC plug.

2.6.2.3 Wall Cleanouts: PVC cleanout adaptor with tapped, countersunk, threaded brass plug. Square 9"x9" wall access cover, with scoriated nickel bronze finish.

2.6.2.4 Grade Cleanouts: PVC cleanout adaptor with countersunk, threaded brass plug. Wade W-8590-D plug. In sidewalks and other finished concrete, provide access cover frames with a non-tilting tractor cover. Wade W-7035-Z or equal.

2.7 Floor Drains in restrooms: Provide floor drains of size as indicated on drawings; and type, including features, as specified herein. Josam, Jay R. Smith, Wade, Zurn, Willoughby Industries.

2.7.1 Floor Drains: Provide inside caulk bottom outlet or TY-Seal hub outlet with adaptor for cast iron trap installation and a 4" deep trap seal. Provide clamping rings for floors with membrane.

2.7.2 Strainer: Provide 5" satin-nickel bronze strainer.

2.7.3 Trap Primer Connection: Provide ½" trap primer tapping.

2.7.4 Basis of Design: Zurn Z-415B-P.

2.8 Floor Drains in holding cells: Provide ligature resistant cast iron floor drains of size as indicated on drawings; and type, including features, as specified herein. Josam, Jay R. Smith, Wade, Zurn, Willoughby Industries.

2.8.1 Floor Drains: Provide inside caulk bottom outlet or TY-Seal hub outlet with adaptor for cast iron trap installation and a 4" deep trap seal. Provide invertible flashing collar, weep holes, adjustable housing with heavy gauge stainless steel, ligature resistant drain insert.

2.8.2 Strainer: Provide 5" ligature resistant drain insert.

2.8.3 Trap Primer Connection: Provide ½" trap primer tapping.

2.8.4 Basis of Design: Willoughby Industries LRFD-5RD-3.

### 3 EXECUTION

- 3.1 Examine substrates and conditions under which soil and waste systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- 3.2 Piping Installation:
- 3.2.1 Install above grade soil and waste piping in accordance with Division-22 Basic Plumbing Materials and Methods section "Pipes and Pipe Fittings", and with Florida Building Code-Plumbing.
- 3.2.2 Install underground soil and waste pipes as indicated and in accordance with Florida Building Code-Plumbing. Lay underground piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.
- 3.2.3 Install building soil and vent piping pitched to drain at minimum slope of ¼" per foot (2%) for piping smaller than 3", and 1/8" per foot (1%) for piping 3" and larger.
- 3.3 Install piping specialties in accordance with Division-23 Basic Mechanical Materials and Methods section "Piping Specialties".
- 3.4 Install supports and anchors in accordance with Division-23 Basic Mechanical Materials and Methods section "Supports and Anchors".
- 3.5 Installation of Cleanouts: Install in above ground piping and building drain piping as indicated, as required by Florida Building Code-Plumbing; and at each change in direction of piping greater than 45°; at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.
- 3.5.1 Size: Cleanouts shall be full size up to 4". Piping over 4" shall have a reducing fitting to accommodate a 4" cleanout unless indicated otherwise on drawings.
- 3.5.2 Install cleanouts to allow adequate clearance for rodding.
- 3.5.3 Protect all finished surfaces of cleanouts with a suitable adhesive covering until construction is completed.
- 3.5.4 Cleanouts to Grade: Provide an 18" x 18" x 8" thick concrete pad around the cleanout. Set the cleanout ferrule, adapter, or access cover frame in the concrete as required. The cleanout shall be extended to the finished grade. The concrete pad shall slope away from the cleanout in all directions approximately one inch. Cover pad with fill to finished grade.
- 3.6 Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.
- 3.7 Vent Flashing Sleeves: Install on stack passing through roof, secure to stack flashing in accordance with manufacturer's instructions. For metal roofs, sleeves and flashing are by Division-7.
- 3.8 Installation of Floor Drains: Install floor drains in accordance with manufacturer's written instructions and in locations indicated.
- 3.8.1 Coordinate flashing work with work of waterproofing and adjoining substrate work.



- 3.8.2 Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
- 3.8.3 Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
- 3.8.4 Position drains so that they are accessible and easy to maintain.
- 3.9 Connection of Trap Primers: Connect trap primers as indicated, and in accordance with manufacturer's installation instructions. Pitch piping towards drain trap, minimum of 1/8" per foot (1%). Adjust trap primer for proper flow.
- 3.10 Piping Runouts to Fixtures: Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated, but in no case smaller than required by Florida Building Code-Plumbing.
- 3.11 Test, clean, flush, and inspect soil and waste piping in accordance with requirements of Division-23 Basic Mechanical Materials and Methods section "Testing, Cleaning and Sterilization of Piping Systems".

END OF SECTION 22 13 16

## SECTION 22 30 00 - PLUMBING FIXTURES, EQUIPMENT, TRIM & SCHEDULE

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-22 Basic Plumbing Requirements and Basic Plumbing Materials and Methods sections apply to work of this section.
- 1.3 Division-23 Basic Mechanical Materials and Methods Sections apply to work of this section.
- 1.4 Extent of plumbing fixtures work required by this section is indicated on drawings and schedules, and by requirements of this section.
- 1.5 Refer to Division-26 sections for field-installed electrical wiring required for plumbing fixtures; not work of this section.
- 1.6 Codes and Standards:
  - 1.6.1 Plumbing Fixture Standards: Comply with applicable portions of Florida Building Code-Plumbing pertaining to materials and installation of plumbing fixtures.
  - 1.6.2 ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
  - 1.6.3 PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
  - 1.6.4 UL Listing: Construct plumbing fixtures requiring electrical power in accordance with UL standards and provide UL-listing and label.
  - 1.6.5 ARI Compliance: Construct and install water coolers in accordance with ARI Standard 1010 "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers", and provide Certification Symbol.
  - 1.6.6 ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People".
- 1.7 Approval Submittals:
  - 1.7.1 Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, furnished specialties and accessories; and installation instructions. Submit manufacturer's assembly-type drawings indicating dimensions, roughing-in requirements, required clearances, and methods of assembly of components and anchorages. The submittal shall be organized by "fixture number" and each fixture package shall be so identified. Each fixture package shall include all of the required fitting and trim, even if such devices are used for more than one fixture.
- 1.8 O&M Data Submittals: Submit a copy of approval submittals. Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble-shooting" maintenance guide. Include these data in O&M manual.
- 1.9 Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

### 2 PRODUCTS

- 2.1 General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide trim, carrier, seats, and valves as specified. Where not specified, provide products as recommended by manufacturer, and as required for complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.
- 2.2 Model Numbers: Basis of design model numbers of a particular manufacturer are listed in the fixture schedule as an aid to contractors. Where conflicts between the model number and the written description occur, the written description shall govern. Where acceptable manufacturers are listed, products are subject to compliance with requirements.
- 2.3 Materials:
- 2.3.1 Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, foundry sand holes, stains, decoloration, or other surface imperfections on finished units are not acceptable.
- 2.3.2 All fixtures shall be white vitreous china unless otherwise specifically noted. Where enameled iron fixtures are specified, they shall be furnished with acid resisting enamel.
- 2.3.3 Where fittings, trim and accessories are exposed or semi-exposed provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.
- 2.3.4 Stainless Steel Sheets: ASTM A 167, Type 302/304, hardest workable temper. Finish shall be No. 4, bright, directional polish on exposed surfaces.
- 2.3.5 Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.
- 2.3.6 Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.
- 2.4 Plumbing Fittings, Trim and Accessories:
- 2.4.1 Faucets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality chrome-plated, cast-brass faucets, valves, or other dispensing devices, of type and size indicated, and as required to operate as indicated.
- 2.4.1.1 Aerators: Provide aerators of types approved by Health Department having jurisdiction.
- 2.4.1.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. American Standard, Chicago Faucet Co., Kohler Co., Speakman Co., T & S Brass and Bronze Works, Water Saver Faucet Co., Zurn.
- 2.4.2 Stops: Provide chrome-plated brass, angle type, manual shutoff valves and 3/8" chrome-plated flexible supply pipes to permit fixture servicing without shutdown of water supply piping systems for all fixtures. Coordinate with fixture requirements.
- 2.4.2.1 Provide loose key stops.
- 2.4.2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Zurn or approved equal.
- 2.4.3 Waste Outlets: Provide removable P-traps, drains, waste arms, tailpieces and wastes-to-wall where drains are indicated for direct connection to drainage system for all fixtures unless otherwise noted. Provide drains, tailpieces and waste arms where indirect drains are indicated. Waste outlets shall be full size of fixture drain connection.

- 2.4.3.1 Provide chrome-plated cast-brass P-traps and drains with cleanout.
- 2.4.3.2 P-traps, wastes and drains of all types shall be 17-gauge.
- 2.4.3.3 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Zurn, or approved equal.
- 2.4.4 Flush Valves: Provide quiet-flush, chrome-plated, cast-brass flush valves with vacuum breaker and screwdriver stop. Where handicap service is indicated, provide ADA compliant handles with the handle on the approach side of the stall.
- 2.4.4.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Sloan Valve Co. or Zurn.
- 2.4.5 Carriers: Provide cast-iron supports for fixtures of either graphitic gray iron, ductile iron, or malleable iron or steel as indicated. Coordinate with specific fixture requirements and conditions of the project.
- 2.4.5.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Josam, Wade, Zurn, J.R. Smith.
- 2.4.6 Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- 2.4.7 Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated brass escutcheons with friction clips.
- 2.4.8 Comply with additional fixture requirements listed for each fixture and as required for a complete and functional system.
- 2.5 Water Closets:
- 2.5.1 General: Provide white china siphon jet type unless otherwise noted.
- 2.5.1.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. American Standard, Kohler, or Zurn.
- 2.5.2 Fixture Seats: Provide white, heavy molded plastic fixture seats with stainless steel self-sustaining check hinges.
- 2.5.2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Bemis Mfg. Co., Beneke Corp., Church or Comfort Seats.
- 2.5.3 Water Closet Schedule:
- WC-1 WATER CLOSET, FLOOR-MOUNT (HANDICAP, TANK TYPE):
- Vitreous china, low consumption 1.28GPF, elongated, 16-3/4" to rim, siphon jet action, closed coupled tank, complete with float, valve, and chrome plated trip lever, bolt caps, color "white", chrome plated solid brass angle stop with flexible chrome plated copper riser, heavy molded plastic, white, elongated, open front seat less cover, with stainless steel, self-sustaining check hinges.
- |                          |                     |
|--------------------------|---------------------|
| Water closet             | Zurn Z5555-K-HET    |
| Supply with stop         | Zurn Z8802CRLK-PC   |
| Seat                     | Zurn Z5955SS-EL-ST5 |
| Closet Bolt/Wax Ring Kit | Zurn Z5972-COMB     |

2.6 Lavatories:

2.6.1 General: Provide white china.

2.6.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. American Standard, Willoughby Industries, Acorn, or Zurn.

2.6.3 Lavatory Schedule:

L-1 LAVATORY, WALL-MOUNT (HANDICAP)

Vitreous china 20" x 18", wall mounted, color "white", 4" centers, rear overflow, and antimicrobial surface to inhibit growth of stain, odor-causing bacteria, mold, and mildew. Furnish floor mounted single carrier with concealed arms, leveling and securing screws, structural uprights, and block bases, secure base to floor for rigid connection with 1/2" x 3-3/4" threaded zinc plated steel heavy duty wedge anchors, complete with stainless steel clip, washer, and threaded nut. Provide chrome plated angle stop to wall with chrome plated 3/8" flexible supply and loose key operator, integral perforated cast brass strainer with 1-1/4" tailpiece, chrome plated 17 gauge cast brass P-trap with cleanout and tube waste to wall. Faucet shall be centerset, polished chrome finish with indexed metal lever handle, grid drain, cast brass waterway and 0.5 gpm aerator. MV-1: Under sink 3/8" compression fitting mixing valve, bronze body, limits hot water between 80°F & 120°F, dual check valves, 40 mesh stainless steel strainer, tamper resistant locking cap. Meets ASSE 1070 standards. Lavatory P-trap and angle valve assemblies shall be insulated with fully molded insulation kit, and light gray color with 3-piece interlocking rap assembly and 2-piece interlocking angle valve assembly. Fasteners shall be nylon-type supplied with kit. Lavatory shall be mounted with a clearance of at least 28" from floor to bottom of the apron. Knee and toe clearances shall be as follows: 27" clear height shall be provided from finished floor to a point on underside of bowl 8" in from front apron. Toe clearance shall be a minimum height of 9" under P-trap and supplies or stops.

Lavatory	American Standard Decorum 9024.004EC
Faucet	American Standard Reliant 7385.003
Supply w/stop	<a href="#">Zurn 8800LRLK-PC</a>
P-Trap	<a href="#">Zurn Z8700-PC</a>
Drain	<a href="#">Zurn Z8743-PC</a>
Mixing Valve	<a href="#">Watts LFUSG-B</a>
Aerator	American Standard V05

2.7 Showers:

2.7.1 General:

2.7.1.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Leonard Valve Co., MCC Powers Process Controls, Symmons, Speakman Co.

2.7.2 Shower Schedule:

SH-1 SHOWER (HANDICAP):

Single handle pressure-balancing mixing valve. Ceramic control cartridge with stainless steel balancing piston. Must hold shower temperature steady with pressure fluctuations up to 85%. packing with Brass adjustable limit stop screw to prohibit valve handle from being turned to excessive hot discharge temperatures. All trim to be copper nickel chrome plated. Service stops to be brass and cast integral with valve body. Two way chrome diverter valve. Brass shower head with arm and flange. 1.5/1.6 gpm Wall/hand shower with 60" flexible metal hose, in-line vacuum breaker, wall connection and flange, 30" slide bar for hand shower mounting and chrome plated metal lever adjustment to meet ADA requirements. Provide mixing valve as shown on plan, set at 120° F (maximum).

Shower Zurn Z-7301-SS-MT-DV-2P-HW-H9-S9-HW11-HW16  
Drain Zurn ZN-415 2" with 5" B

2.8 Water Heaters:

2.8.1 Accessories: VB, relief, pan, stand, etc.

2.8.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Chronomite, Rheem, Seisco, State, A.O. Smith.

2.8.3 Water Heater Schedule:

IWH-1 ELECTRIC INSTANTANEOUS WATER HEATER:

Electric, tankless water heater, low activation of 0.35 GPM turn on flow, nichrome heating coil. ¾" inlet and outlet. Heater must meet NSF/ANSI 61 and 372 as well as UL 834. All parts shall be field replaceable. Unit shall be rated for 480V/3phase, 43.2kw. Coordinate with electrical contractor. Water heater shall have 5 year warranty. Heater shall have built in leak detection with automatic heating shutdown.

Water Heater Chronomite ER-90L/480\_3P

IWH-2 ELECTRIC INSTANTANEOUS WATER HEATER:

Electric, tankless water heater, low activation of 0.20 GPM turn on flow, nichrome heating coil. ¾" inlet and outlet. Heater must meet NSF/ANSI 61 and 372 as well as UL 834. All parts shall be field replaceable. Unit shall be rated for 277V/1phase, 11.08kw. Coordinate with electrical contractor. Water heater shall have 5 year warranty. Heater shall have built in leak detection with automatic heating shutdown. Provide NEMA 4x enclosure for installation in wet environment.

Water Heater Chronomite CM-40L/277

2.9 Penal Fixtures:

2.9.1 General: Penal fixtures shall be stainless steel and ligature resistant.

2.9.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Acorn, Willoughby Industries, or approved equal.

2.9.3 Penal Fixture Schedule:

PL-1 PENAL LAVATORY, WALL-MOUNT, HANDICAP:

14 gauge, type 304 stainless steel rear mounted lavatory with oval bowl (13"x9-1/2"x5-1/2" deep), integral strainer fast drain outlet, air vent and elbow waste 1-1/2" NPT. Fixture shall be ligature resistant. Exposed surfaces to be polished to #4 satin finish. Fixture to have front access. Anchoring shall be by standard 4-point system (threaded rods, nuts and washers). Vandal proof, pneumatic valve assembly to include pneumatic push-button pump, pneumatically operated single temperature metering valve, cast bronze valve inlets with integral mounting lugs, integral checkstops and replaceable strainers. Water inlets shall be reversible for either top or bottom supplies with flexible tubing to fixture connection. Pushbutton shall require a maximum of 5 lbs force to operate pneumatic, adjustable (5-90 seconds), non-hold open metering valve. Provide keyed escutcheon plates. Provide 1-1/2" cast brass thru wall waste extension with cast brass P-trap/cleanout and 20 gauge galvanized steel wall sleeve. Provide mixing valve, MV-1 in mechanical chase.

Lavatory Willoughby Industries ASHS-1013-06  
Valve Willoughby pneumatic hot & cold metering

PL-2 PENAL LAVATORY, WALL-MOUNT, STANDARD:

14 gauge, type 304 stainless steel rear mounted lavatory with oval bowl (13"x9-1/2"x5-1/2" deep), integral strainer fast drain outlet, air vent and elbow waste 1-1/2" NPT. Fixture shall be ligature resistant. Exposed surfaces to be polished to #4 satin finish. Fixture to have front access. Anchoring shall be by standard 4-point system (threaded rods, nuts and washers). Vandal proof, pneumatic valve assembly to include pneumatic push-button pump, pneumatically operated single temperature metering valve, cast bronze valve inlets with integral mounting lugs, integral checkstops and replaceable strainers. Water inlets shall be reversible for either top or bottom supplies with flexible tubing to fixture connection. Pushbutton shall require a maximum of 5 lbs force to operate pneumatic, adjustable (5-90 seconds), non-hold open metering valve. Provide keyed escutcheon plates. Provide 1-1/2" cast brass thru wall waste extension with cast brass P-trap/cleanout and 20 gauge galvanized steel wall sleeve. Provide mixing valve, MV-1 in mechanical chase.

Lavatory Willoughby Industries ASHS-1013-06  
Valve Willoughby pneumatic hot & cold metering

PSH-1 PENAL SHOWER (RECESSED, REAR MOUNTED, HANDICAP):

14 gauge, type 304 domestic stainless steel, rear mounted, ligature-resistant recessed shower panel with exposed surfaces polished to satin finish. Provide shower valve, check stop, 1.5 GPM flow control and 2 nonadjustable vandal resistant shower heads. Anchoring shall be by standard 8-point system (threaded rods, nuts and washers). Vandal resistant, pneumatic valve assembly to include pneumatic push-button pump, pneumatically operated single temperature metering valve, cast bronze valve inlets with integral mounting lugs, integral checkstops and replaceable strainers. Pushbutton shall require a maximum of 5 lbs force to operate pneumatic, adjustable (5-90 seconds), non-hold open metering valve. Valve shall require no outside air supply. Provide keyed escutcheon plates and 18 gauge galvanized steel mounting frame.

Shower Panel [Willoughby Industries WRS-ADA-L-PML1-PBH-1.5-CSH](#)  
Valve Willoughby PML1

PSH-2 PENAL SHOWER (RECESSED, REAR MOUNTED, STANDARD):

14 gauge, type 304 domestic stainless steel, rear mounted, ligature-resistant recessed shower panel with exposed surfaces polished to satin finish. Provide shower valve, check stop, 1.5 GPM flow control and 2 nonadjustable vandal resistant shower heads. Anchoring shall be by standard 8-point system (threaded rods, nuts and washers). Vandal resistant, pneumatic valve assembly to include pneumatic push-button pump, pneumatically operated single temperature metering valve, cast bronze valve inlets with integral mounting lugs, integral checkstops and replaceable strainers. Pushbutton shall require a maximum of 5 lbs force to operate pneumatic, adjustable (5-90 seconds), non-hold open metering valve. Valve shall require no outside air supply. Provide keyed escutcheon plates and 18 gauge galvanized steel mounting frame.

Shower Panel [Willoughby Industries WRS-L-PML1-PBH-1.5-CSH](#)  
Valve Willoughby PML1

PWC-1 PENAL WATER CLOSET, REAR-MOUNT, (CONCEALED, HYDRAULIC VALVE, HANDICAP):

Rear mounted, wall outlet, floor mounted, ligature-resistant blowout type, stainless steel, back spud water closet with wall outlet. Anchoring shall be by standard 6-point system (threaded rods, nuts and washers). Provide quiet, concealed, hydraulic actuated, 1.6gpf water closet flushometer with dual filtered bypass, non-hold-open actuator, angle stop, adjustable tailpiece, high back pressure vacuum breaker, elbow flush connection and coupling for 1-1/2" NPT back inlet, chrome plated exposed parts. ADA height.

Water Closet  
Valve

Willoughby Industries ASETW-1490-FM-FA-HC  
Zurn ZH6611AV-MBP

PWC-2 PENAL WATER CLOSET, REAR-MOUNT, (CONCEALED, HYDRAULIC VALVE, HANDICAP):

Rear mounted, wall outlet, floor mounted, ligature-resistant blowout type, stainless steel, back spud water closet with wall outlet. Anchoring shall be by standard 6-point system (threaded rods, nuts and washers). Provide quiet, concealed, hydraulic actuated, 1.6gpf water closet flushometer with dual filtered bypass, non-hold-open actuator, angle stop, adjustable tailpiece, high back pressure vacuum breaker, elbow flush connection and coupling for 1-1/2" NPT back inlet, chrome plated exposed parts.

Water Closet  
Valve

Willoughby Industries ASETW-1490-FM-FA  
Zurn ZH6611AV-MBP

PDF-1 PENAL DRINKING FOUNTAIN:

Ligature-resistant 15" wide stainless steel wall hung, rear mount, drinking fountain with push button control in front & deck mounted bubbler. Drinking fountain shall be 14 gauge, type 304 stainless steel, with exposed surfaces polished to #4 satin finish. Drinking fountain shall be vandal and ligature resistant. Anchoring shall be by standard 4-point system using threaded rods, nuts and washers. Refer to architectural plans for mounting height. Verify final location and finish with Architectural drawings. Provide chrome plated stop to wall with chrome plated 3/8" flexible supply. Provide 1-1/2" chrome plated 17 gauge cast brass P-trap with cleanout. Chrome plated loose key angle stop to wall with 3/8" chrome plated flexible cold water supplies.

Bubbler  
Trap  
Supplies

Willoughby WBDF-1519-HC  
Zurn Z-8702-PC  
Zurn Z-8800LK

3" FD FLOOR DRAIN:

Cast iron body, bottom outlet and trap primer connection. Adjustable housing with heavy gauge, stainless steel, ligature resistant drain insert. 6" diameter drain insert and 3" pipe size.

Floor Drain

Willoughby Industries LRFD-6RD-3

SS-1 SERVICE SINK:

Stainless steel, rear mounted service sink. Fixture shall be 14 gauge, type 304 stainless steel, all welded, with exposed surfaces polished to a #4 satin finish. Rectangular bowl shall be 24"x19"x10" deep and shall be on-floor mounted with wall outlet. Spout shall have plain end, with dual temp pneumatic metering faucet with 0.5GPM flow rate and ligature resistant pneumatic push buttons. Provide mixing valve, MV-1 in mechanical chase. Provide with integral P-trap. Anchoring shall be by 6 or 8 point system using threaded rods, nuts and washers.

Service sink

Willoughby Industries SS-2419-FM-SE-PML1-PBH

2.10 Thermostatic Mixing Valves:

2.10.1 General:

2.10.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item.

2.10.3 Thermostatic Mixing Valve Schedule:



MV-1 WATER MIXING VALVE (THERMOSTATIC MIXING):

Under sink 3/8" compression fitting mixing valve, bronze body, limits hot water between 80°F & 120°F, dual check valves, 40 mesh stainless steel strainer, tamper resistant locking cap. Meets ASSE 1070 standards.

Exposed Mixing Valve [Watts LFUSG-B](#)

3 EXECUTION

- 3.1 Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- 3.2 Install plumbing fixtures of types indicated where shown and at indicated heights. Install in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Install in accordance with ADA and applicable handicap code requirements. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of Florida Building Code-Plumbing pertaining to installation of plumbing fixtures. Furnish templates for cut-outs in countertops. Coordinate exact fixture locations with countertop shop drawings.
- 3.3 Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement. Mount at heights shown on the drawings. Fixture heights are floor-to-rim distance. Fitting heights are to centerline.
- 3.4 Install stop valve in water supply to each fixture.
- 3.5 After fixtures are set, the crack between the fixture and wall shall be caulked with DAP silicone-based caulking, or approved product specified by the architect.
- 3.6 Protect installed fixtures from damage during remainder of construction period.
- 3.7 Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- 3.8 Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.
- 3.9 Clean plumbing fixtures, trim, aerators, and strainers of dirt and debris upon completion of installation.
- 3.10 Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow stream and specified gpm.
- 3.11 Adjust or replace washers to prevent leaks at faucets and stops.

**END OF SECTION 223000**

## SECTION 23 01 00 - MECHANICAL GENERAL

### 1 GENERAL

- 1.1 The work covered by this division consists of providing all labor, equipment and materials and performing all operations necessary for the installation of the mechanical work as herein called for and shown on the drawings.
- 1.2 Related Documents:
- 1.2.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- 1.2.2 This is a Basic Mechanical Requirements Section. Provisions of this section apply to work of all Division 23 sections.
- 1.2.3 Review all other contract documents to be aware of conditions affecting work herein.
- 1.2.4 Definitions:
- 1.2.4.1 Provide: Furnish and install, complete and ready for intended use.
- 1.2.4.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.
- 1.2.4.3 Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- 1.3 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for his work and pay all fees and charges incidental thereto.
- 1.4 Verification of Owner's Data: Prior to commencing any work the Contractor shall satisfy himself as to the accuracy of all data as indicated in these plans and specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Architect/Engineer in order that proper adjustments can be anticipated and ordered. Commencement by the Contractor of any work shall be held as an acceptance of the data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions or inaccuracies of the said data.
- 1.5 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and accidental damage.
- 1.6 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be constructed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.
- 1.7 Field Measurements and Coordination:
- 1.7.1 The intent of the drawings and specifications is to obtain a complete and satisfactory installation. Separate divisional drawings and specifications shall not relieve the Contractor or subcontractors from full compliance of work of his trade indicated on any of the drawings or in any section of the specifications.
- 1.7.2 Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.

- 1.7.3 Coordinate work in this division with all other trades in proper sequence to insure that the total work is completed within contract time schedule and with a minimum cutting and patching.
- 1.7.4 Locate all apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on mechanical drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.
- 1.7.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval.
- 1.7.6 Carefully examine any existing conditions, piping, and premises. Compare drawings with existing conditions. Report any observed discrepancies. It shall be the Contractor's responsibility to properly coordinate the work and to identify problems in a timely manner. Written instructions will be issued to resolve discrepancies.
- 1.7.7 Because of the small scale of the drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate piping, ductwork, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and for coordination with all trades. Contractor shall not order materials or perform work without such verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or piping cannot be fitted, the Architect/Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.
- 1.8 Guarantee:
- 1.8.1 The Contractor shall guarantee labor, materials and equipment for a period of ~~five~~ (4-5) years from Final Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.
- 1.8.2 Owner reserves right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving Contractor of his responsibilities during guarantee period.
- 1.9 Approval Submittals:
- 1.9.1 When approved, the submittal control log and submittals shall be an addition to the specifications herewith, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.
- 1.9.1.1 Shop drawings, product literature, and other approval submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following.
- 1.9.1.1.1 Submittals shall be properly organized in accordance with the approved submittal control log.
- 1.9.1.1.2 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.
- 1.9.1.1.3 Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control number, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approval stamps. A sample cover sheet is included at the end of this section.

- 1.9.1.1.4 Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the cover sheet.
- 1.9.1.1.5 Submittals that include a series of fixtures or devices (such as plumbing fixtures or valves) shall be organized by the fixture number or valve type and be marked accordingly. Each fixture must include all items associated with that fixture regardless of whether or not those items are used on other fixtures.
- 1.9.1.1.6 The electrical design shown on the drawings supports the mechanical equipment basis of design specifications at the time of design. If mechanical equipment is submitted with different electrical requirements, it is the responsibility of the mechanical contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the mechanical submittal with a written statement that this change will be provided at no additional cost. Mechanical submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.
- 1.9.2 If the shop drawings show variation from the requirements of contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in writing in his letter of transmittal and on the submittal cover sheet in order that, if acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.
- 1.9.3 Review of shop drawings, product literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer each such deviation in writing at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, product literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.
- 1.9.4 Submit shop drawings as called for in other sections after award of the contract and before any material is ordered or fabricated. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than ¼" per foot), with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.
- 1.10 Test Reports and Verification Submittals: Submit test reports, certifications and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, submit the reports, review the reports and take corrective action within the scheduled contract time.
- 1.11 O&M Data Submittals: Submit Operation and Maintenance data as called for in other sections. When a copy of approval submittals is included in the O&M Manual, only the final "Approved" or "Approved as Noted" copy shall be used. Contractor shall organize these data in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit manuals at the Substantial Completion inspection.

## 2 PRODUCTS

- 2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them at the building and shall be of reputable manufacturers. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.
- 2.2 Equipment and Materials:

- 2.2.1 Shall be new and the most suitable grade for the purpose intended. Equipment furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar units or equipment.
- 2.2.2 Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated or painted.
- 2.2.3 The label of the approving agency, such as UL, IBR, ASME, ARI, AMCA, by which a standard has been established for the particular item shall be in full view.
- 2.2.4 The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer's latest design.
- 2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.
- 2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.
- 2.2.7 Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material and type of construction desired. Manufacturer's products shown on the drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products, or the particular products of named manufacturers, meet the detailed specifications and that size and arrangement of equipment are suitable for installation.
- 2.2.8 Model Numbers: Catalog numbers and model numbers indicated in the drawings and specifications are used as a guide in the selection of the equipment and are only listed for the contractor's convenience. The contractor shall determine the actual model numbers for ordering materials in accordance with the written description of each item and with the intent of the drawings and specifications.
- 2.3 Requests for Substitution:
- 2.3.1 Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product or material specified.
- 2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.
- 2.3.2.1 Required product cannot be supplied in time for compliance with Contract time requirements.
- 2.3.2.2 Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disability as certified by Contractor.
- 2.3.2.3 Substantial cost advantage is offered Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.
- 2.3.3 All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products:

Principal of operation.  
Materials of construction or finishes.  
Thickness of gauge of materials.  
Weight of item.  
Deleted features or items.  
Added features or items.  
Changes in other work caused by the substitution.  
Performance curves.

If the approved substitution contains differences or omissions not specifically called to the attention of the Architect/Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products (or to have the substituted products replaced) at the Contractor's expense.

### 3 EXECUTION

- 3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.
- 3.2 Coordination:
- 3.2.1 The Contractor shall be responsible for full coordination of the mechanical systems with shop drawings of the building construction so the proper openings and sleeves or supports are provided for piping, ductwork, or other equipment passing through slabs or walls.
- 3.2.2 Any additional steel supports required for the installation of any mechanical equipment, piping, or ductwork shall be furnished and installed under the section of the specifications requiring the additional supports.
- 3.2.3 It shall be the Contractor's responsibility to see that all equipment such as valves, dampers, filters and such other apparatus or equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the drawings.
- 3.2.4 All connections to fixtures and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.
- 3.2.5 The contractor shall protect equipment, material, and fixtures at all times. He shall replace all equipment, material, and fixtures which are damaged as a result of inadequate protection.
- 3.2.6 Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.
- 3.2.7 Start of work will be construed as acceptance of suitability of work of others.
- 3.3 Interruption of Service: Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.
- 3.4 Phasing: Provide all required temporary valves, piping, ductwork, equipment and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.

- 3.5 Cutting and Patching: Notify General Contractor to do all cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under this section. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.
- 3.6 Equipment Setting: Bolt equipment directly to concrete pads or vibration isolators as required, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.
- 3.7 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 23. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.
- 3.8 Clean-up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, contractor is to carefully clean up and leave premises and all portions of building free from debris and in a clean and safe condition.
- 3.9 Start-up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, start-up shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in start-up check.
- 3.10 Climate Control: Operate heating and cooling systems as required after initial startup to maintain temperature and humidity conditions to avoid freeze damage and warping or sagging of ceilings and carpet.
- 3.11 Record Drawings:
- 3.11.1 During the progress of the work the Contractor shall record on their field set of drawings the exact location, as installed, of all piping, ductwork, equipment, and other systems which are not installed exactly as shown on the contract drawings.
- 3.11.2 Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 sections.
- 3.12 Acceptance:
- 3.12.1 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.
- 3.12.2 Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with project, for one day to instruct permanent operating personnel in operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.
- 3.12.3 Operation and Maintenance Manuals: Furnish four complete manuals bound in ring binders with Table of Contents, organized, and tabbed by specification section. Manuals shall contain:
- Detailed operating instructions and instructions for making minor adjustments.
  - Complete wiring and control diagrams.
  - Routine maintenance operations.
  - Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
  - Copies of approved submittals.
  - Copies of all manufacturer's warranties.
  - Copies of test reports and verification submittals.

- 3.12.4 Record Drawings: Submit record drawings.
- 3.12.5 Test and Balance Report: Submit four certified copies. The Report shall be submitted for review prior to the Substantial Completion Inspection unless otherwise required by Division 1.
- 3.12.6 Acceptance will be made on the basis of tests and inspections of job. A representative of firm that performed test and balance work shall be in attendance to assist. Contractor shall furnish necessary mechanics to operate system, make any necessary adjustments and assist with final inspection.

END OF SECTION 23 01 00



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## SECTION 23 05 13 - ELECTRIC MOTORS

### 1 GENERAL

- 1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Section apply to work of this Section.
- 1.2
- 1.3 Extent of motors required by this section is indicated on drawings and/or specified in other Division-23 sections.
- 1.4 Comply with the requirements of Division 26.
- 1.5 UL Compliance: Comply with applicable UL standards pertaining to motors.
- 1.6 Approval Submittals:
  - 1.6.1 Product Data: When required by other Division-23 sections, submit manufacturers standard product data sheets for each type of motor provided. Submit with Division-23 section using the motors, not as a separate submittal. Mark data sheet with arrows indicating product being supplied and list by unique descriptive name all motors to which each data sheet applies. Clearly indicate type, service factor, rpm, duty cycle, voltage, phase, nominal full load efficiency, power factor and insulation class. Field verify and coordinate mounting and frame requirements for matching the drive.
  - 1.7 O&M Data Submittals: Submit a copy of approval submittals. Submit operation and maintenance data for each type of motor. Include these data in O&M Manual. Submit two copies of nameplate data sheet for each motor. One copy shall be included with the O&M Manual and a second copy shall be inserted in a waterproof pouch or bag and attached to the motor. Nameplate data sheets shall be typed or neatly printed and shall include all data on the motor nameplate plus a unique motor description such as "AHU-3 Fan Motor", "Distribution Pump #1" or similar description.

### 2 PRODUCTS

- 2.1 Acceptable Manufacturers: Subject to compliance with requirements, General Electric, Baldor, US Electric, or approved equal.
- 2.2 General:
  - 2.2.1 Motors shall conform to applicable portions of NEMA Standard MG-1, Motors and Generators.
  - 2.2.2 Motors shall be sized for the application such that when the driven equipment is operated at rated capacity the motor current will not exceed the full-load nameplate current. Service factor shall not be used in normal operation.
- 2.3 Motor Design:
  - 2.3.1 Integral Horsepower Motors:
    - 2.3.1.1 Motors shall be open drip-proof or totally enclosed fan cooled as shown on the drawings or listed in the Division 23 section requiring motors.
    - 2.3.1.2 Motors shall be three phase, 60 hertz, nominal 1800 rpm, rated at 200 volts for 208 volt systems, 230 volts for 240 volt systems and 460 volts for 480 volt systems.

- 2.3.1.3 Motors shall be NEMA Design B and shall have 1.15 service factor or greater at 60 hertz.
- 2.3.1.4 Insulation Systems
  - 2.3.1.4.1 In fixed speed applications, motors shall have Class B insulation with 80°C rise over 40°C ambient.
  - 2.3.1.4.2 For variable frequency drive (VFD) applications, motors shall have Class F insulation with 105°C rise over 40°C ambient. Motor manufacturer shall identify motors being used for VFD applications by marking the motor with a stainless steel name-plate "Inverter Ready".
- 2.3.1.5 Motor efficiencies shall be based on IEEE-112, 1984, Test Method B, as specified in NEMA Standard MG1-12.53. NEMA motor efficiency and power factor shall be clearly shown on the motor nameplate. Inverter duty motors shall have a CIV rating based on NEMA.
- 2.3.1.6 Motors shall be premium efficiency type and shall meet or exceed the following minimum nominal efficiencies at rated voltage.

230/460 VOLT, 3 PHASE

HORSEPOWER RANGE	MINIMUM NOMINAL EFFICIENCY	MINIMUM ACCEPTABLE POWER FACTOR
1 to 2 hp	84.0 pct.	75.0 pct
3 to 5 hp	87.5 pct.	77.0 pct
7.5 hp	89.5 pct.	80.0 pct
10 hp	90.2 pct.	80.0 pct
15 hp	91.0 pct.	82.0 pct
20 to 25 hp	92.0 pct.	82.0 pct
30 hp	92.4 pct.	82.0 pct
40 to 50 hp	93.0 pct.	85.0 pct
60 hp	93.6 pct.	85.0 pct
75 hp	94.1 pct.	85.0 pct
100 to 125 hp	94.5 pct.	85.0 pct
150 to 200 hp	95.0 pct.	85.0 pct
over 200 hp	95.4 pct.	87.0 pct

200 VOLT, 3 PHASE

HORSEPOWER RANGE	MINIMUM NOMINAL EFFICIENCY	MINIMUM ACCEPTABLE POWER FACTOR
1 to 2 hp	84.0 pct.	75.0 pct
3 to 5 hp	87.5 pct.	77.0 pct
7.5 hp	89.5 pct.	80.0 pct
10 hp	90.2 pct.	80.0 pct
15 hp	91.0 pct.	80.0 pct
20 to 25 hp	92.0 pct.	80.0 pct

2.3.1.7 Motors 25 hp and larger which are to be installed outdoors or in other high humidity areas shall be equipped with silicone rubber space heaters. Space heaters shall be energized when motor is de-energized.

2.3.2 Fractional Horsepower Motors one-half hp and above:

2.3.2.1 Motors shall be open drip-proof or totally enclosed fan cooled as shown on the drawings or listed in the Division 23 section requiring motors.

2.3.2.2 Motors shall be three phase, 60 hertz, nominal 1800 rpm, rated at 200, 230 or 460 volts as shown on the drawings.

2.3.2.3 Motors shall be NEMA Design B with class B insulation, unless used with variable frequency drives.

2.3.3 Fractional Horsepower Motors less than one-half hp:

2.3.3.1 Motors shall be single phase, 60 hertz, rated at 120 volts with integral thermal protection.

2.4 Overload Protection: Properly sized overload protection shall be provided for each motor. This protection may be an integral part of the motor or may be part of the motor controller and shall interrupt each ungrounded conductor.

3 EXECUTION

3.1 Motor Size and Location:

3.1.1 Size and location of motors shown on the drawings are based on a particular design and may change with a different manufacturer. Submittal of shop drawings or product literature indicating motor sizes or locations different from that designed indicates that Contractor has fully coordinated any required changes to the electrical system with other trades. Approval (if made) is on this basis and no additional cost will be allowed for any changes.

3.1.2 Contractor shall verify and make any necessary adjustments to electrical service, branch circuit wiring, branch circuit protection, overload protection, disconnect and controller (starter), or VFD based on actual nameplate data of the motors supplied prior to installation. Where applicable, connect motor winding thermostat to VFD.

3.2 Motor Voltages: Contractor shall field verify system voltage prior to ordering or installing any motors. Submittal of shop drawings or product literature indicating motor voltages indicates that Contractor has fully coordinated the motor with the electrical system and that any discrepancies have been resolved. Approval (if made) is on this basis and no additional cost will be allowed for any changes.

- 3.3 Motor Mounting: Adjust motor mounting as required to adjust the drive train for proper belt operation and to accommodate sheave changes or other requirements of the test and balance work.

END OF SECTION 23 05 13

## SECTION 23 05 20 - PIPES AND PIPE FITTINGS

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Mechanical Materials and Methods section, and is part of each Division-23 section making reference to pipes and pipe fittings specified herein.
- 1.3 Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division-23 sections.
- 1.4 Codes and Standards:
  - 1.4.1 Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.
  - 1.4.2 Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.
- 1.5 Test Report and Verification Submittals:

Submit welding certification for all welding installers.  
Submit brazing certification for all brazing installers.

### 2 PRODUCTS

- 2.1 Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.
- 2.2 Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.
- 2.3 Piping Materials/Products:
  - 2.3.1 Soldering Materials:
    - 2.3.1.1 Tin-Antimony (95-5) Solder: ASTM B-32, Grade 95TA.
    - 2.3.1.2 Silver-Phosphorus Solder: ASTM B-32, Grade 96TS.
  - 2.3.2 Pipe Thread Tape: Teflon tape.
  - 2.3.3 Protective Coating: Koppers Bitumastic No. 505 or equal.
  - 2.3.4 Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast iron flanges; raised-face for steel flanges, unless otherwise noted.
  - 2.3.5 Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials. Materials shall be determined by installer to comply with installation requirements.

- 2.3.6 Brazing Materials: Silver content of not less than 15%. Materials shall be determined by installer to comply with installation requirements.
- 2.4 Copper Tube and Fittings:
  - 2.4.1 Copper Tube:
    - 2.4.1.1 Copper Tube: ASTM B88; Type K or L as indicated for each service; hard-drawn temper unless specifically noted as annealed.
    - 2.4.1.2 ACR Copper Tube: ASTM B280.
  - 2.4.2 Fittings:
    - 2.4.2.1 Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
    - 2.4.2.2 Copper Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.
    - 2.4.2.3 Cast-Copper Flared Tube Fittings: ANSI B16.26.
- 2.5 Steel Pipes and Pipe Fittings
  - 2.5.1 Pipes:
    - 2.5.1.1 Black Steel Pipe: ASTM A-53 or A-120, seamless.
    - 2.5.1.2 Galvanized Steel Pipe: ASTM A-53 or A-120, seamless.
  - 2.5.2 Pipe Fittings:
    - 2.5.2.1 Threaded Cast Iron: ANSI B16.4.
    - 2.5.2.2 Threaded Malleable Iron: ANSI B16.3; plain or galvanized as indicated.
    - 2.5.2.3 Malleable Iron Threaded Unions: ANSI B16.39; selected by installer for proper piping fabrication and service requirements including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
    - 2.5.2.4 Threaded Pipe Plugs: ANSI B16.14.
    - 2.5.2.5 Flanged Cast Iron: ANSI B16.1, including bolting.
    - 2.5.2.6 Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing.
    - 2.5.2.7 Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short radius elbows and returns, rated to match connected pipe.
    - 2.5.2.8 Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than schedule 80 pipe where length remaining unthreaded is less than 1 ½ inches, and where pipe size is less than 1 ½ inches, and do not thread nipples full length (no close-nipples).
- 2.6 Plastic Pipes and Fittings:
  - 2.6.1 Pipes:
    - 2.6.1.1 PVC DWV Pipe: ASTM D-2665, Schedule 40.

2.6.2 Fittings:

2.6.2.1 PVC Solvent Cement: ASTM D-2564.

2.6.2.2 PVC DWV Socket: ASTM D-2665.

3 EXECUTION

3.1 Installation

3.1.1 General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leak proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings, not bushings. Align piping accurately at connections, within 1/16" misalignment tolerance.

3.1.2 Comply with ANSI B31 Code for Pressure Piping.

3.1.3 Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to ½" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation.

3.1.4 Concealed Piping: Unless specifically noted as "Exposed" on the drawings, conceal piping from view in finished and occupied spaces, by locating in column enclosures, chases, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

3.1.5 Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical, communications, or data equipment spaces and enclosures unless shown. Install drip pan under piping that must run through electrical spaces.

3.1.5.1 Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with building construction and installed work.

3.2 Piping System Joints: Provide joints of the type indicated in each piping system.

3.2.1 Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply non-acid type solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

3.2.2 Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed. Paint exposed threads to retard rusting.

3.2.3 Flanged Joints: Match flanges within piping system, and at connection with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets. Bolts shall project 1/8" to 3/8" beyond nut face when tight.



- 3.2.4 Weld pipe joints in accordance with recognized industry practice and as follows. Be guided by ANSI B.31.
- 3.2.4.1 Weld pipe joints only when ambient temperature is above 0°F.
- 3.2.4.2 Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.
- 3.2.4.3 Use pipe clamps or tack-weld joints; 4 welds for pipe sizes to 10". All welds shall be open-butt.
- 3.2.4.4 Build up welds with root pass, followed by filler pass and then a cover pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
- 3.2.4.5 Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
- 3.2.4.6 At Installer's option, install forged branch-connection fittings wherever branch pipe is less than 3" and at least two pipe sizes smaller than main pipe indicated; or install regular "T" fitting. Weld-O-Let or equal.
- 3.2.5 Plastic Pipe Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards.
- 3.2.5.1 Solvent-cemented joints shall be made in accordance with ASTM D-2235 and ASTM F-402.
- 3.2.5.2 PVC sewer pipe bell/gasket joints shall be installed in accordance with ASTM D-2321.
- 3.2.6 Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B.31.
- 3.3 Piping Installation
- 3.3.1 Install piping to allow for expansion and contraction.
- 3.3.2 Isolate all copper tubing from steel and concrete by wrapping the pipe at the contact point, and for one inch on each side, with a continuous plastic sleeve. Isolate all copper tubing installed in block walls with a continuous plastic sleeve.
- 3.3.3 Underground Piping:
- 3.3.3.1 Provide plastic tape markers over all underground piping. Provide copper wire over all underground plastic piping outside the building. Locate markers 18" above piping.
- 3.3.3.2 Coat the following underground (uninsulated) pipes with a heavy coat of bitumastic or provide an 8 mil polyvinyl sleeve: black steel pipe, galvanized steel pipe, copper tubing.

END OF SECTION 23 05 20

## SECTION 23 05 21 - PIPING SPECIALTIES

### 1 GENERAL

- 1.1 Drawings and general provisions of contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Mechanical Materials and Methods section, and is part of each Division-23 section making reference to or requiring piping specialties specified herein.

### 2 PRODUCTS

- 2.1 General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.
- 2.2 Escutcheons:
  - 2.2.1 General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
  - 2.2.2 Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
  - 2.2.3 Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.
- 2.3 Dielectric Unions: Provide standard products recommended by manufacturer Victaulic Style 47 dielectric waterways for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action and stop corrosion. .
- 2.4 Fire Barrier Penetration Seals:
  - 2.4.1 Provide seals for any opening through fire-rated walls, floors, or ceilings used as passage for mechanical components such as piping or ductwork in accordance with the requirements of Division 7.
- 2.5 Fabricated Piping Specialties:
  - 2.5.1 Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.
  - 2.5.2 Pipe Sleeves: Provide pipe sleeves of one of the following:
    - 2.5.2.1 Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6" 16 gage; over 6", 14 gage.
    - 2.5.2.2 Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
    - 2.5.2.3 Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

- 2.5.3 Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:
- 2.5.3.1 Caulking and Sealant: Provide foam or caulking and sealant compatible with piping materials used.
- 2.6 Low Pressure Y-Type Pipeline Strainers:
- 2.6.1 General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Provide Type 304 stainless steel screens.
- 2.6.1.1 Water Strainers: Select for 200 psi working pressure (water, oil or gas). Provide 20 mesh screens through 2" size and 1/16" perforations for 2½" size and larger.
- 2.6.2 Select from the following types:
- 2.6.2.1 Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
- 2.6.2.2 Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
- 2.6.2.3 Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
- 3 EXECUTION
- 3.1 Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.
- 3.2 Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.
- 3.3 Fire Barrier Penetration Seals: Provide pipe sleeve as required. Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions. Refer to Division 7.
- 3.4 Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.
- 3.5 Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves ¼" above level floor finish, and ¾" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.
- 3.5.1 Install sleeves in fire-rated assemblies in accordance with the listing of the assembly and the fire barrier sealant.

- 3.5.2 Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings. Fill annular space with caulking or fire barrier sealant as required.
- 3.5.3 Install steel-pipe sleeves at floor penetrations. Fill annular space with caulking or fire barrier sealant as required.
- 3.5.4 Install iron-pipe sleeves at all foundation wall penetrations and at exterior penetrations; both above and below grade. Fill annular space with caulking or mechanical sleeve seals.
- 3.6 Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers  $\frac{3}{4}$ " and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.
- 3.7 Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:
- Temperature control valves.
  - Pressure reducing valves.
  - Temperature or pressure regulating valves.

END OF SECTION 23 05 21

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## SECTION 23 05 23 - VALVES

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work of this section.
- 1.2 This section is a Division-23 Basic Materials and Methods section, and is part of each Division-23 section making reference to or requiring valves specified herein.
- 1.3 Extent of valves required by this section is indicated on drawings and/or specified in other Division-23 sections.
- 1.4 Quality Assurance:
- 1.4.1 Valve Dimensions: For face-to-face and end-to-end dimensions of flanged or welding-end valve bodies, comply with ANSI B16.10.
- 1.4.2 Valve Types: Provide valves of same type by same manufacturer.
- 1.4.3 Valve Listing: For valves on fire protection piping, provide UL listing.
- 1.5 Approval Submittals: Submit product data, catalog cuts, specifications, and dimensioned drawings for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valves with Division-23 section using the valves, not as a separate submittal. For each valve, identify systems where the valve is intended for use.

Gate Valves. Type GA.  
Check Valves. Type CK.  
Ball Valves. Type BA.  
Butterfly Valves. Type BF.

- 1.6 O&M Data Submittals: Submit a copy of approval submittals. Submit installation instructions, maintenance data and spare parts lists for each type of valve. Include this data in the O&M Manual.

### 2 PRODUCTS

- 2.1 General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with specifications and installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections.
- 2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the producers listed for each valve type. The model numbers are listed for contractor's convenience only. In the case of a model number discrepancy, the written description shall govern.
- 2.3 Gate Valves:
- 2.3.1 Packing: Select valves designed for repacking under pressure when fully opened, equipped with non-asbestos packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.
- 2.3.2 Comply with the following standards:

Cast Iron Valves: MSS SP-70. Cast Iron Gate Valves, Flanged and Threaded Ends.

Bronze Valves: MSS SP-80. Bronze Gate, Globe, Angle and Check Valves.

Steel Valves: ANSI B16.34. Steel Standard Class Valve Ratings.

### 2.3.3 Types of gate (GA) valves:

- 1 Threaded Ends 2" and Smaller (GA1): Class 125, bronze body, screwed bonnet, rising stem, solid wedge. Stockham B-100. Nibco T-111. Crane 428. Milwaukee 148.
- 2 Soldered Ends 2" and Smaller (GA2): Class 125, bronze body, screwed bonnet, non-rising stem, solid wedge. Stockham B-108 or B-109. Nibco S-111. Crane 1334. Milwaukee 149.
- 3 Flanged Ends 2½" and Larger (GA3): Class 125, iron body, bronze mounted, bolted bonnet, rising stem, OS&Y, solid wedge. Stockham G-623. Nibco F617-0. Crane 465½. Milwaukee F2885.
- 4 Threaded Ends 2" and Smaller (GA4): Class 150, bronze body, screwed bonnet, rising stem, solid wedge. Stockham B-122. Nibco T-131. Crane 431. Milwaukee 1150.
- 5 Soldered Ends 2" and Smaller (GA5): Class 150, bronze body, screwed bonnet, rising stem, solid wedge. Stockham B-124. Nibco S-134. Milwaukee 1169.
- 6 Threaded Ends 2" and Smaller (GA6): 175 WWP, bronze body, screwed bonnet, rising stem, OS&Y, solid wedge, UL-listed. Stockham B-133. Nibco T-104-0.
- 7 Flanged Ends 2½" and Larger (GA7): 175 WWP, iron body, bolted bonnet, rising stem, OS&Y, solid wedge, UL listed. Stockham G-634. Nibco F-607-0TS
- 8 Threaded Ends 2" and Smaller (GA8): Class 200, bronze body, union bonnet, rising stem, solid wedge, renewable seat. Stockham B-132. Nibco T-154-SS. Milwaukee 1174.
- 9 Flanged Ends 2½" and Larger (GA9): Class 250, iron body bronze mounted, bolted bonnet, rising stem, OS&Y, solid wedge. Stockham F-667. Nibco F-667-0. Crane 7½E. Milwaukee F-2894.
- 10 Threaded Ends 2" and Smaller (GA10): Class 300, bronze body, union bonnet, rising stem, solid wedge, renewable seat. Stockham B-145. Nibco T-174-SS. Crane 634E. Milwaukee 1184.
- 11 Flanged Ends 2½" and Larger (GA11): Class 300, cast steel body, bolted bonnet, rising stem, solid wedge, seal-welded seat rings. Provide trim to match use. Stockham 30-0F. Crane 33.
- 12 Flanged Ends 2½" and Larger (GA12): 300 WWP, iron body, bolted bonnet, bronze mounted, rising stem, OS&Y, solid wedge, UL-listed. Stockham F-670. Nibco F-697-0.

### 2.4 Check Valves:

2.4.1 Construction: Construct valves of castings free of any impregnating materials. Construct valves with a bronze regrinding disc with a seating angle of 40° to 45°, unless a composition disc is specified. Provide stop plug as renewable stop for disc hanger, unless otherwise specified. Disc and hanger shall be separate parts with disc free to rotate. Support hanger pins on both ends by removable side plugs.

### 2.4.2 Comply with the following standards:

Cast Iron Valves: MSS SP-71. Cast Iron Swing Check Valves, Flanged and Threaded Ends.

Bronze Valves: MSS SP-80. Bronze Gate, Globe, Angle and Check Valves.

Steel Valves: ANSI B16.34. Steel Standard Class Valve Ratings.

### 2.4.3 Types of check (CK) valves:

- 1 Threaded Ends 2" and Smaller (CK1): Class 125, bronze body, screwed cap, horizontal swing, bronze disc. Stockham B-319. Nibco T-413-BY. Crane 1707. Milwaukee 509.
- 2 Soldered Ends 2" and Smaller (CK2): Class 125, bronze body, screwed cap, horizontal swing, bronze disc. Stockham B-309. Nibco S-413-B. Crane 1707S. Milwaukee 1509.
- 3 Flanged Ends 2½" and Larger (CK3): Class 125, iron body, bronze-mounted, bolted cap, horizontal swing, cast-iron or composition disc. Stockham G-931 or G-932 as applicable. Nibco F918-B. Crane 373. Milwaukee F2974 as applicable.
- 4 Threaded Ends 2" and Smaller (CK4): 200 WWP, bronze body, screwed cap, horizontal swing, regrinding type bronze disc, for fire sprinkler use. Nibco KT-403-W.
- 5 Flanged Ends 2½" and Larger (CK5): 175 WWP, iron body, bolted cap, bronze mounted, composition disc, UL listed, with ball drip if required. Stockham G-940. Nibco F-908-W.
- 6 Threaded Ends 2" and Smaller (CK6): Class 200, bronze body, screwed cap, Y-pattern swing, regrinding bronze disc. Stockham B-345. Nibco T-453-B. Crane 36. Milwaukee 518/508.
- 7 Flanged Ends 2½" and Larger (CK7): Class 250, iron body, bronze mounted, bolted cap, cast-iron disc. Stockham F-947. Nibco F-968-B. Crane 39E. Milwaukee F2970.
- 8 Threaded Ends 2" and Smaller (CK8): Class 300, bronze body, screwed cap, Y-pattern swing, regrinding bronze disc. Stockham B-375. Nibco T-473-B. Crane 76E. Milwaukee 517/507.
- 9 Flanged Ends 2½" and Larger (CK9): Class 300, cast steel body, bolted cap, horizontal swing, seal welded seat rings, chromium stainless disc. Stockham 30-SF. Crane 159.

## 2.5 Ball Valves:

2.5.1 General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.

2.5.2 Construction: Ball valves shall be rated for 150 psi saturated steam and 600 psi non-shock cold water. Pressure containing parts shall be constructed of ASTM B-584 alloy 844, or ASTM B-124 alloy 377. Valves shall be furnished with blow-out proof bottom loaded stem constructed of ASTM B-371 alloy 694 or other approved low zinc material. Provide TFE packing, TFE thrust washer, chrome-plated ball and reinforced teflon seats. Valves 1" and smaller shall be full port design. Valves 1¼" and larger shall be conventional port design. Stem extensions shall be furnished for use in insulated piping where insulation exceeds ½" thickness.

2.5.3 Comply with the following standards:

MSS SP-72. Ball Valves with Flanged or Butt Welding Ends for General Service.

MSS SP-110. Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

2.5.4 Types of ball (BA) valves:

- 1 Threaded Ends 2" and Smaller (BA1): Bronze two-piece full port body with adjustable stem packing, stainless steel ball, trim, and handle. Nibco T-585-66. Stockham T285-BR-R-T. Milwaukee BA100S. Apollo 77-100.
- 2 Soldered Ends 2" and Smaller (BA2): Bronze three-piece full port body with adjustable stem packing. Nibco S-595-Y-66. Milwaukee BA350. Apollo 82-200.
- 3 Threaded Ends 1" and Smaller (BA3): Bronze two-piece full port body, UL listed (UL 842) for use with flammable liquids and LP gas. Nibco T-585-70-UL.



- 4 Threaded Ends 2" and Smaller (BA4): 175 WWP, bronze two-piece body, UL listed for fire protection service. Nibco KT-585-70-UL and KT-580-70-UL.
- 5 Threaded Ends 2" and Smaller (BA5): 400 WWP, bronze two-piece body, for fire protection service. Nibco KT-580.
- 6 Threaded Ends 2½" and Smaller (BA6): 300 WWP, bronze three-piece body, gear operator with handwheel, indicator flag, accepts tamper switch, for fire protection, UL listed. Nibco T-505-4 and G-505-4.
- 7 Flanged Ends 2½" and Larger (BA7): Class 150, carbon steel full bore two-piece body with adjustable stem packing, stainless steel ball, trim, and handle. Nibco F515-S6 series. Apollo 88A-240.

## 2.6 Butterfly Valves:

2.6.1 General: Comply with MSS SP-67, Butterfly Valves. Provide butterfly valves designed for tight shut-off. Where used for terminal or equipment removal or repair, select lug type valves. Select wafer type valves for other applications. Provide gear operators on all butterfly valves 6" and larger.

### 2.6.2 Types of butterfly (BF) valves:

- 1 Wafer Type 3" and Larger (BF1): 200 CWP, cast-iron body, lever-operated, cadmium-plated ductile iron disc, Type 410 stainless steel stem, EPT seat. Stockham LG-512. Nibco WD 2110-3. Crane 42-FXB-TL. Milwaukee MW222E-8416.
- 2 Lug Type 3" and Larger (BF2): 200 CWP, cast-iron body, lever-operated, cadmium-plated ductile iron disc, Type 410 stainless steel stem, EPT seat. Stockham LG-712. Nibco LD 2110-3. Crane 44-FXB-TL. Milwaukee ML132B-8416.
- 3 Wafer Type 3" and Larger (BF3): 150/200 CWP, cast-iron body, gear-operated, cadmium-plated ductile iron disc, Type 410 stainless steel stem, EPT seat. Stockham LG-522 and LG-521. Nibco WD 2110-5. Crane 42-FXB-G. Milwaukee MW 122B-8115.
- 4 Lug Type 3" and Larger (BF4): 150/200 CWP, cast-iron body, gear-operated, cadmium-plated ductile iron disc, Type 410 stainless steel stem, EPT seat. Stockham LG-722 and LG-721. Nibco LD 2110-5. Crane 44-FXB-G. Milwaukee ML 132B-8115.
- 5 Wafer Type 4" and Larger (BF5): 175 WWP, cast-iron body, gear-operated, nickel-plated ductile iron disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-52U. Nibco WD 3510-8.
- 6 Lug Type 4" and Larger (BF6): 175 WWP, cast-iron body, gear-operated, nickel-plated ductile iron or aluminum bronze disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-72U. Nibco LD 3510-8.
- 7 Grooved Type 4" and Larger (BF7): 175 WWP, cast-iron body, gear-operated, nickel-plated ductile iron or aluminum bronze disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-82U. Nibco GD 1765-2.

## 2.7 Valve Features:

2.7.1 General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ANSI B31.1

2.7.2 Valve features specified or required shall comply with the following:

- 1     Threaded: Provide valve ends complying with ANSI B2.1.
- 2     Solder-Joint: Provide valve ends complying with ANSI B16.18.
- 3     Trim: Fabricate pressure-containing components of valve, including stems (shafts) and seats from brass or bronze materials, of standard alloy recognized in valve manufacturing industry unless otherwise specified.
- 4     Non-Metallic Disc: Provide non-metallic material selected for service indicated in accordance with manufacturer's published literature.
- 5     Renewable Seat: Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.
- 6     Extended Stem: Increase stem length by 2" minimum, to accommodate insulation applied over valve.

### 3     EXECUTION

#### 3.1    Installation:

3.1.1   General: Install valves where required for proper operation of piping and equipment, including valves in branch lines to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward below horizontal plane.

3.1.2   Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

3.1.3   Applications Subject to Corrosion: Do not install bronze valves and valve components in direct contact with steel, unless bronze and steel are separated by dielectric insulator.

3.2     Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:

3.2.1   Tube Size 2" and Smaller: Threaded valves.

3.2.2   Pipe Size 2" and Smaller: Threaded valves.

3.3     Non-Metallic Disc: Limit selection and installation of valves with non-metallic disc to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

3.4     Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

3.5     Installation of Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction flow.

END OF SECTION 23 05 23

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## SECTION 23 05 29 - SUPPORTS, ANCHORS, AND SEALS

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Materials and Methods section, and is a part of each Division-23 section making reference to or requiring supports, anchors, and seals specified herein.
- 1.3 Extent of supports, anchors, and seals required by this section is indicated on drawings and/or specified in other Division-23 sections.
- 1.4 Code Compliance: Comply with applicable codes pertaining to product materials and installation of supports, anchors, and seals.
- 1.5 MSS Standard Compliance:
  - 1.5.1 Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.
  - 1.5.2 Select and apply pipe hangers and supports, complying with MSS SP-69.
  - 1.5.3 Fabricate and install pipe hangers and supports, complying with MSS SP-89.
  - 1.5.4 Terminology used in this section is defined in MSS SP-90.
- 1.6 UL Compliance: Provide products which are Underwriters Laboratories listed .

### 2 PRODUCTS

- 2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide supports and hangers by Grinnel, Michigan Hanger Company, B-Line Systems, or approved equal.
- 2.2 Horizontal-Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
  - 2.2.1 Adjustable Steel Clevises: MSS Type 1.
  - 2.2.2 Steel Double Bolt Pipe Clamps: MSS Type 3.
  - 2.2.3 Adjustable Steel Band Hangers: MSS Type 7.
  - 2.2.4 Steel Pipe Clamps: MSS Type 4.
  - 2.2.5 Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.
  - 2.2.6 Single Pipe Rolls: MSS Type 41.
  - 2.2.7 Adjustable Roller Hanger: MSS Type 43.
  - 2.2.8 Pipe Roll Stands: MSS Type 44 or Type 47.

- 2.3 Vertical-Piping Clamps: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- 2.3.1 Two-Bolt Riser Clamps: MSS Type 8.
- 2.3.2 Four-Bolt Riser Clamps: MSS Type 42.
- 2.4 Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- 2.4.1 Steel Turnbuckles: MSS Type 13.
- 2.4.2 Malleable Iron Sockets: MSS Type 16.
- 2.5 Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods.
- 2.5.1 Center Beam Clamps: MSS Type 21.
- 2.5.2 C-Clamps: MSS Type 23.
- 2.5.3 Malleable Beam Clamps: MSS Type 30.
- 2.5.4 Side Beam Brackets: MSS Type 34.
- 2.5.5 Concrete Inserts: MSS Type 18.
- 2.6 Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- 2.6.1 Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
- 2.6.2 Protection Saddles: MSS Type 39; use with rollers, fill interior voids with segments of insulation matching adjoining insulation.
- 2.7 Miscellaneous Materials:
- 2.7.1 Metal Framing: Provide products complying with NEMA STD ML 1.
- 2.7.2 Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.
- 2.7.3 Cement Grout: Portland cement (ANSI/ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ANSI/ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

2.7.4 Heavy-Duty Steel Trapezes: Fabricate from steel shapes or continuous channel struts selected for loads required; weld steel in accordance with AWS standards.

### 3 EXECUTION

#### 3.1 Preparation

3.1.1 Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

3.1.2 Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, and installers of other work requiring coordination with work of this section for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

#### 3.2 Installation of Building Attachments:

3.2.1 Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.2.2 In areas of work requiring attachments to existing concrete, use self drilling rod inserts, Phillips Drill Co., "Red-Head" or equal.

#### 3.3 Installation of Hangers and Supports:

3.3.1 General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69 or as listed herein, whichever is most limiting. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

3.3.1.1 Horizontal steel pipe and copper tube 1-1/4" diameter and smaller: support on 6 foot centers.

3.3.1.2 Horizontal steel pipe and copper tube 1-1/2" diameter and larger: support on 10 foot centers.

3.3.1.3 Vertical steel pipe and copper tube: support at each floor.

3.3.1.4 Plastic pipe: support in accordance with manufacturer's recommendations and the Florida Building Code, Plumbing.

3.3.1.5 Fire protection piping: support in accordance with NFPA 13.

3.3.2 Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.3.3 Paint all black steel hangers with black enamel. Galvanized steel and copper clad hangers do not require paint.

3.3.4 Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

- 3.3.5 Provision for Movement:
- 3.3.5.1 Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- 3.3.5.2 Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- 3.3.5.3 Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.
- 3.3.6 Insulated Piping: Comply with the following installation requirements.
- 3.3.6.1 Shields: Where low-compressive-strength insulation or vapor barriers are indicated, install coated protective shields.
- 3.3.6.2 Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
- 3.3.7 Support fire protection piping independently of other piping.
- 3.4 Installation of Anchors:
- 3.4.1 Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.
- 3.4.2 Fabricate and install anchors by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- 3.4.3 Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and elbows. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.
- 3.4.4 Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
- 3.5 Equipment Bases:
- 3.5.1 Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 23. Size bases to extend minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.
- 3.5.2 Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands. Prime and paint with black enamel.

END OF SECTION 23 05 29

## SECTION 23 05 48 - VIBRATION ISOLATION

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Mechanical Materials and Methods section, and is part of each Division-23 section making reference to vibration isolation equipment.
- 1.3 Extent of vibration isolation required by this section is indicated on drawings and/or specified in other Division-23 sections.
- 1.4 Approval Submittals: When required by other Division-23 sections, submit product data sheets for each type of vibration isolation equipment including configuration and rating data. Submit with Division-23 section using vibration isolation, not as a separate submittal. Provide calculations showing supported weight, deflection, and isolator size and type for each item of supported equipment. Submit for:
- Equipment Mountings. Type EM.  
Hangers. Type HA.  
Bases and Frames. Type BF.
- 1.5 O&M Data Submittals: Submit a copy of approval submittals for each type of vibration isolation equipment. Include this data in O&M Manual.

### 2 PRODUCTS

- 2.1 General: Provide factory-fabricated products recommended by manufacturer for use in service indicated. Provide products of types and deflections indicated; provide proper selection as determined by Installer to comply with specifications and installation requirements. Provide sizes which properly fit with equipment. All metal parts installed outside shall be hot dipped galvanized after fabrication.
- 2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide vibration isolation equipment of: Mason Industries, Keflex, Consolidated Kinetics, Vibration Mountings & Controls, Wheatley or approved equal. All vibration isolators shall be supplied by a single approved manufacturer.
- 2.3 Equipment Mountings:
- 2.3.1 Select mountings with the required deflection and fastening means. Provide steel rails or bases as required to compensate for equipment rigidity and overhang.
- 2.3.2 Types of equipment mountings (EM):
- 1 Spring Mountings (EM1): Spring isolators shall be free-standing and laterally stable without any housing. All mounts shall have leveling bolts. Spring diameter shall be not less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately one. Provide a nominal static deflection of at least 1.0". Basis of Design: Mason Industries SLFH.
  - 2 Spring Mountings with Housings (EM2): Spring isolators shall consist of open, stable steel springs and include vertical travel limit stops to control extension when weight is removed. The housing of the spring unit shall serve as blocking during erection of equipment. Provide a nominal static deflection of at least 1.0". All mountings used outside shall be hot dipped



galvanized. Basis of Design: Mason Industries SLR.

- 3 Spring Mountings with Housings (EM3): Spring isolators shall consist of open, stable steel springs with neoprene inserts to limit movement between upper and lower housing on start and stop. Provide a nominal static deflection of at least 1.0". Mountings shall be specifically designed for critical areas on light-weight floors. Basis of Design: Mason Industries C.
- 4 Neoprene Mountings (EM4): Double deflection neoprene-in-shear mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered. The top and bottom surfaces shall be neoprene ribbed and bolt holes shall be provided in the base. Basis of design: Mason Industries ND.
- 5 Pads (EM5): Waffle or ribbed pattern neoprene pads shall be fabricated from 40-50 durometer neoprene. Provide rigid steel plate and mounting angles as required. Basis of design: Mason Industries Super W.

#### 2.4 Hangers:

2.4.1 Select hangers with the required deflection. Provide all required hanger rods and fasteners.

#### 2.4.2 Types of hangers (HA):

- 1 Hangers (HA1): Vibration hangers shall contain a steel spring set in a neoprene cup manufactured with a grommet to prevent short-circuiting of the hanger rod. The cup shall contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Spring diameters and hanger box lower-hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Basis of Design: Mason Industries 30.
- 2 Hangers (HA2): Vibration hangers shall contain a laterally stable steel spring and 0.3" deflection neoprene or fiberglass element in series. A neoprene neck shall be provided where the hanger rod passes through the steel box supporting the isolator mount to prevent metal to metal contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Basis of Design: Mason Industries 30N.
- 3 Hangers (HA3): Double deflection neoprene-in-sheer or EPDM hangers. Units shall be complete with projected neoprene bushing to prevent steel-to-steel contact between hanger box and hanger rod. Average static deflection shall be not less than 0.4 inches. Basis of Design: Mason Industries HD.

#### 2.5 Bases and Frames (BF):

2.5.1 Select mounting bases and frames as required for equipment dimensions, service access and fastening means. Provide all fasteners. Coordinate and provide required vibration isolators to match mounting bases and frames.

#### 2.5.2 Types of bases and frames (BF):

- 1 Steel Base Frame for Floor-Mounted Equipment (BF1): Provide frames consisting of structural steel sections sized, spaced and connected to form a rigid base which will not twist, rack, deform or deflect in any manner that will negatively affect the operation of the supported equipment or the performance of the vibration-isolation mounts. Frames shall be of adequate size and plan form to support basic equipment units and motors plus any associated pipe elbow or duct elbow supports and electrical control elements or other components closely related and requiring resilient support in order to prevent vibration transfer from equipment to the building

structure. Frames shall include side mounting brackets for attachment to vibration isolation floor mounts. The clearance between the underside of any frame or mounted equipment unit and the top of the building structure below shall be at least 2 inches. Basis of Design: Mason Industries WFSL.

- 2 Concrete Inertia Block for Floor-Mounted Equipment (BF2): Provide concrete inertia blocks formed of stone-aggregate concrete (150 lbs./cu.ft.) cast between appropriate steel reinforcing perimeter structural steel channels. Inertia block thickness shall be not less than 1/12 the longest dimension of the mounted equipment or equipment assembly. Inertia blocks shall be built to form a rigid base which will not twist, rack, deform, deflect or crack in any manner that will negatively affect the operation of the supported equipment or the performance of the vibration-isolation mounts. Inertia blocks shall be of adequate size and plan form to support basic equipment units and motors plus any associated pipe or duct elbow supports, electrical control elements or other components closely related and requiring resilient support in order to prevent vibration transfer from equipment to the building structure. Inertia blocks shall include side mounting bracket pockets for spring mounting. The clearance between the underside of any inertia block and the top of the building structure below shall be at least 2 inches. The vibration isolator supplier may furnish the structural steel perimeter frame, including reinforcing and anchor bolts. Basis of Design: Mason Industries KSL/BMK.
- 3 Steel Rails (BF3): Provide steel rails of channels or angles with vibration isolators as required. Basis of Design: Mason Industries, RND or RC.
- 4 Vibration Isolation Base for Rooftop Equipment (BF4): Provide aluminum vibration isolation bases that fit over roof curb and under the equipment. Provide spring isolators having a 1" minimum static deflection, resilient snubbers for wind resistance, closed cell weather seal at top and bottom, and EDPM flexible connection around entire perimeter. The unit shall provide a water-tight system. Basis of Design: Mason Industries CMAB.
- 5 Vibration Isolation Curb for Rooftop Equipment (BF5): Provide steel spring isolation curb with cadmium or zinc electroplated steel springs on 1/4" thick neoprene pads to support the upper frame. The upper frame must provide continuous support for the equipment and must be held captive by 1/4" thick neoprene snubber bushings. Minimum spring deflection is 1 1/2". Provide galvanized steel counter-flashing and EPDM bellows for the corners. Provide access covers for all springs. The entire assembly shall be waterproof. Curbs shall be a minimum of 12" high and shall include 2" thick insulation. Provide curbs designed to accommodate for roof pitch so that equipment is set level.

Provide perimeter angle and cross members with two layers of 5/8" waterproof sheetrock at the floating member of the curb. Stagger sheetrock joints. Sheetrock must completely surround all ducts and shall be caulked. Where the mechanical arrangement prevents attaching to the floating member, the barrier shall be attached as high as possible on the fixed curb with 1" thick closed cell neoprene flexible seals around the ducts. A 4" layer of 1.5 pcf fiberglass shall cover the entire solid roof surface under the unit. Basis of Design: Mason Industries RSC-dB.

### 3 EXECUTION

- 3.1 Install vibration isolation devices for the duty indicated and for ease of inspection, adjustment, and proper operation. Install in accordance with the manufacturer's written instructions and coordinate with shop drawings of supported equipment.
- 3.2 All connections to fixtures and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.
- 3.3 Piping, ductwork and conduit shall not be suspended from one another or physically contact one another. Vibrating systems shall be kept free from non-vibrating systems.

3.4 Equipment Mountings:

- 3.4.1 Unless otherwise shown or specified, all floor-mounted equipment shall be set on housekeeping equipment bases. Refer to Division-23 section "Supports, Anchors, and Seals".
- 3.4.2 No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators, and such direct support is approved by the equipment manufacturer. All support frames shall be sufficiently stiff and rigid so as to prevent distortion and misalignment of components installed thereon.
- 3.4.3 Align equipment mountings for a free, plumb installation. Isolators that are binding, offset or fully compressed will not be accepted.

3.5 Hangers:

- 3.5.1 Position vibration isolation hangers so that hanger housing may rotate a full 360 degrees without contacting any object.
- 3.5.2 Install steel angles, channels, rods and fasteners to level equipment, piping or ductwork and to evenly distribute the supported weight.

3.6 Bases and Frames:

- 3.6.1 Unless otherwise indicated, all equipment mounted on vibration-isolated bases shall have a minimum operating clearance of 2 inches between the structural steel frame and the concrete housekeeping pad or floor beneath the equipment. The clearance space shall be checked to ensure that no construction debris has been left to short-circuit or restrict the proper operation of the vibration isolation system.
- 3.6.2 Drain piping connected to vibrating equipment shall not physically contact any building construction or non-isolated systems or components.
- 3.7 Connections of Ducts: Ducts shall be connected to fan intakes and discharges by means of flexible connectors in accordance with Division-23 section "Ductwork Accessories" so that all vibrating equipment is fully isolated.

END OF SECTION 23 05 48

## SECTION 23 05 53 - MECHANICAL IDENTIFICATION

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Mechanical Materials and Methods section, and is part of each Division-23 section making reference to or requiring identification devices specified herein.
- 1.3 Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-23 sections.
- 1.4 Refer to Division-26 sections for identification requirements of electrical work; not work of this section. Refer to other Division-23 sections for identification requirements for controls; not work of this section.
- 1.5 Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

### 2 PRODUCTS

- 2.1 General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-23 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.
- 2.2 Painted Identification Materials
  - 2.2.1 Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1- $\frac{1}{4}$ " high letters for ductwork and not less than  $\frac{3}{4}$ " high letters for access door signs and similar operational instructions.
  - 2.2.2 Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
  - 2.2.3 Identification Paint: Standard identification enamel.
- 2.3 Plastic Pipe Markers
  - 2.3.1 Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers.
    - 2.3.1.1 Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with name as shown or specified.
    - 2.3.1.2 Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.
- 2.4 Valve Tags:
  - 2.4.1 Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in  $\frac{1}{4}$ " high letters and sequenced valve numbers  $\frac{1}{2}$ " high, and with  $\frac{5}{32}$ " hole for fastener. Provide 1- $\frac{1}{2}$ " diameter tags, except as otherwise indicated.

- 2.4.2 Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" square black tags with white lettering, except as otherwise indicated.
- 2.5 Engraved Plastic-Laminate Signs:
- 2.5.1 General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style a minimum of 3/4" tall and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
- 2.5.2 Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
- 2.5.3 Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
- 2.5.4 Ceiling Grid Mounted Tags: White 1/2" lettering engraved in a 3/4" black background, screwed parallel to the ceiling grid.
- 2.6 Stamped Nameplates: Provide equipment manufacturer's standard stamped nameplates for motors, AHUs, pumps, etc.
- 3 EXECUTION
- 3.1 Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- 3.2 Ductwork Identification:
- 3.2.1 General: Identify air supply, return, exhaust, intake and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow, in black or white. Example: **AHU-1 Supply**  
➔
- 3.2.2 Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures, and at 50' spacings along exposed runs.
- 3.2.3 Access Doors: Provide stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate and procedural information.
- 3.3 Piping System Identification:
- 3.3.1 General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
- 3.3.1.1 Plastic pipe markers.
- 3.3.1.2 Stenciled markers, black or white for best contrast.
- 3.3.2 Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.
- 3.3.2.1 Near each valve and control device.

- 3.3.2.2 Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
- 3.3.2.3 Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
- 3.3.2.4 At access doors, manholes and similar access points which permit view of concealed piping.
- 3.3.2.5 Near major equipment items and other points of origination and termination.
- 3.3.2.6 Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
- 3.3.2.7 On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- 3.3.3 The following piping shall be color-coded where exposed to view by completely painting the piping with the indicated color. Use standard colors where exposed in finished spaces. Use standard identification methods in concealed areas.

Fire protection piping - Red

- 3.4 Valve Identification: Provide coded valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. Coordinate code with operating instructions. For valves located above acoustical lay in ceilings, provide an additional engraved plastic valve tag, mechanically affixed to the ceiling grid below the valve (white letters on black background). When multiple equipment and/or valve tags are installed in a room, orient all tags the same direction.
- 3.5 Valve Charts: Provide framed, glass covered valve charts in each mechanical room. Identify coded valve number, valve function, and valve location for each valve. Provide floor plan with approximate location of each valve identified.
- 3.6 Mechanical Equipment Identification: Install engraved plastic laminate sign on a vertical surface on or near each major item of mechanical equipment and each operational device. Label shall indicate type of system and area served. For equipment located above acoustical lay in ceilings, provide an additional engraved plastic valve tag, mechanically affixed to the ceiling grid below the valve (white letters on black background). When multiple equipment and/or valve tags are installed in a room, orient all tags the same direction. Provide signs for the following general categories of equipment and operational devices:
  - 3.6.1 Main control and operating valves, including safety devices.
  - 3.6.2 Meters, gauges, thermometers and similar units.
  - 3.6.3 Fuel-burning units including boilers, furnaces, and heaters.
  - 3.6.4 Pumps, compressors, chillers, condensers, and similar equipment.
  - 3.6.5 Heat exchangers, coils, evaporators, cooling towers, heat recovery units and similar equipment.
  - 3.6.6 Fans, blowers, primary balancing dampers and VAV boxes.
  - 3.6.7 HVAC air handlers and fan coil units.
  - 3.6.8 Air conditioning indoor and outdoor units.

- 3.7 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all major equipment items such as motors, pumps, AHUs, etc. Where motors are hidden from view (within equipment casing, or otherwise not easily accessible, etc.), the equipment supplier shall furnish a duplicate motor data nameplate to be affixed to the equipment casing in an easily visible location, unless data is already included on the equipment nameplate.]
- 3.8 Adjusting and Cleaning:
- 3.8.1 Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
- 3.8.2 Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 23 05 53

## SECTION 23 05 56 - ACCESS DOORS

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Mechanical Materials and Methods section, and is part of each Division-23 section making reference to or requiring access panels specified herein.
- 1.3 Approval Submittals:
- 1.3.1 Product Data: When required by other Division-23 sections, submit product data for access doors. Submit with Division-23 section using access doors, not as a separate submittal. Include rating data.
- 1.4 O&M Data Submittals: Submit a copy of approval submittal. Include this data in O&M Manuals.

### 2 PRODUCTS

- 2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide access doors by Milcor, Jay R. Smith, Zurn, BOICO, Elmdor, or approved equal.
- 2.2 General: Where floors, walls and ceilings must be penetrated for access to plumbing work, provide types of access doors indicated. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.
- 2.3 Access Door Construction: Except as otherwise indicated, fabricate wall/ceiling door units of welded stainless steel construction with welds ground smooth and brushed finish; 16-gauge frames and 14-gauge flush panel doors; 175° swing with concealed spring hinges; flush screw-driver-operated cam locks.

### 3 EXECUTION

- 3.1 Access doors shall be installed to operate and service all plumbing equipment including valves, dampers, duct access panels, and other items requiring maintenance that are concealed above or behind finished construction. Access doors shall be installed in walls, chase and floors as necessary, but are not required in accessible suspended ceiling systems.
- 3.2 Access doors shall be installed by the Division installing the substrate construction. However, responsibility for furnishing and determining location of access doors is part of this Division's work. The style of access door shall be suitable for construction into which installed.
- 3.3 Access doors shall be sized and located as required to provide proper maintenance and service access in accordance with the manufacturer's recommendations and code authority requirements for all devices and equipment.

END OF SECTION 23 05 56



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## SECTION 23 05 73 - EXCAVATION & BACKFILL

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Mechanical Materials and Methods section, and is part of each Division-22 and 23 section making reference to or requiring excavation and backfill specified herein.
- 1.3 Existing Utilities: Underground utilities shown were taken from old drawings. The exact location of these utilities and irrigation branches and abandoned services are not known. Use extreme caution when excavating.
- 1.4 Refer to other Division-22 and 23 sections and/or drawings for specific requirements of the particular piping system being installed. Where another Division-22 or 23 section or the drawings conflict with requirements of this section, the other Division-22 or 23 section or the drawings shall take precedence over the general requirements herein.
- 1.5 OSHA: Contractor employee worker protection for all trenching and excavation operations shall comply with 29 CFR 1926.650 Subpart P and all current OSHA requirements.
- 1.6 Trench Safety Act: Contractor shall comply with all requirements of Florida Statutes Chapter 553, including the requirement to provide a separate line item to identify the cost to comply on a per lineal foot of trench and per square foot of shoring.

### 2 PRODUCTS

- 2.1 Sand: Clean, hard, uncoated grains free from organic matter or other deleterious substances. Sand for backfill shall be of a grade equal to mortar sand.
- 2.2 Gravel: Clean, well graded hard stone or gravel, free from organic material. Size range to be from No. 4 screen retentions to 1".
- 2.3 Earth: Fill free of clay, muck, stones, wood, roots or rubbish.
- 2.4 Identification Tape: Polyethylene 6 inches wide, 0.004 inches thick, continuously printed with "CAUTION" in large letters and type of pipe below.
- 2.5 Copper Identification Wire: 14-gauge.

### 3 EXECUTION

- 3.1 Ditching and Excavation: Shall be performed by hand wherever there is a possibility of encountering obstacles or any existing utility lines of any nature whatsoever. Where clear and unobstructed areas are to be excavated, appropriate machine excavation methods may be employed. Avoid use of machine excavators within the limits of the building lines.
- 3.2 Bedding: Excavate to bottom grade of pipe to be installed, and shape bed of undisturbed earth to contour of pipe for a width of at least 50% of pipe diameter. If earth conditions necessitate excavation below grade of the pipe, such as due to the presence of clay, muck, or roots, subcut and bring bed up to proper elevation with clean, new sand (as described in paragraph 2.1), deposited in 6" layers and tamped. Notify Architect/Engineer if subcut exceeds 12", or if bed is of an unstable nature. In this case a 6" minimum layer of gravel will be required before sand bedding begins. Submit cost proposal if the earth conditions require subcut in excess of 12" or if gravel is required to achieve proper bedding.

- 3.3 Placing: Pipe shall be carefully handled into place. Avoid knocking loose soil from the banks of the trench into the pipe bed. Rig heavier sections with nylon slings in lieu of wire rope to avoid crushing or chipping. Pipe which is handled with insulation in place, coated pipe, and jacketed pipe shall have special handling slings as required to prevent damage to the material.
- 3.4 Backfilling: Deposit clean new sand (as described in paragraph 2.1) to 6" above the pipe and tamp. Then deposit sand or earth carefully in 6" layers, maintaining adequate side support, especially on nonferrous piping materials. Compact fill in 6" layers, using mechanical means, up to the top elevation of the pipe, and in 12" layers to rough or finish grade as required. Fine grade and restore surface to original condition.
- 3.5 Special: Excavations shall be installed and maintained in satisfactory condition during the progress of the work. Subsurface structures are to be constructed in adequately sized excavations. Dewatering equipment shall be installed and properly maintained where required. Shoring shall be employed in the event of unstable soil condition, and in all cases where required by OSHA regulations and necessary to protect materials and personnel from injury.
- 3.6 Identification: Install identification tape directly above all underground piping, one tape for each pipe where multiple pipes are installed. Depth of tape shall be at least 6 inches below finished grade and 24" above buried pipe. Install copper wire above non-metallic pipes.
- 3.7 Depth of Cover: Minimum cover for underground piping is two feet unless indicated otherwise.

END OF SECTION 23 05 73

**SECTION 23 05 90 - START-UP REQUIREMENTS FOR HEATING, VENTILATING, & AIR CONDITIONING (HVAC) SYSTEMS**

1 GENERAL

1.1 Intent: It is the intent of this section to require that the startup requirements and report noted herein be performed prior to starting TAB work on each system. Work can be phased with permission of the Engineer.

1.2 Coordination:

1.2.1 The Contractor shall furnish to the TAB Contractor a complete set of plans, specifications, addenda, shop drawings, equipment performance data sheets, change orders, etc. as requested by the TAB Contractor.

1.2.2 The Contractor shall participate in a TAB coordination meeting to discuss interface requirements with the TAB Contractor and to establish a schedule for TAB work prior to start of TAB work. The TAB will be performed by an independent company contracted by the owner.

1.3 Test Reports and Verification Submittals:

1.3.1 Submit Startup Report as described herein for each system. Attach Factory Startup Report for equipment as required by other Division-23 sections.

2 PRODUCTS: None

3 EXECUTION:

3.1 The TAB work shall not commence until the Engineer has received written notice from the Contractor that HVAC systems are 100% complete and are fully operational. Submit Startup Report as described herein.

3.2 The Contractor shall place all HVAC systems and equipment into complete operation during each working day of TAB work.

3.3 The Contractor shall provide access to HVAC systems and equipment by supplying ladders and/or scaffolding, and opening access panels and equipment room doors.

3.4 The TAB Contractor will provide to the Contractor TAB punch lists of non-complying HVAC work as they are discovered. The Contractor shall replace or repair non-complying work as soon as possible in order not to delay completion of TAB work.

3.5 Airside Systems: The Contractor shall provide the following information to the Engineer to substantiate proper start-up and preliminary adjustments of air handler units, belt driven fans, and duct systems.

3.5.1 Verify that air grilles (supply, return, exhaust, transfer, outdoor, etc.) are installed and connected to the duct system.

3.5.2 Verify that duct systems are clean of debris.

3.5.3 Verify that ducts attached with flexible connectors are aligned within ½" and have a uniform gap between ducts of 1"-1.5". Flexible connectors shall not leak and shall be insulated.

3.5.4 Verify that filters are clean and filter spacers are installed.

- 3.5.5 Verify that balancing dampers at grilles and branch ducts are operational and are fully opened.
  - 3.5.6 Verify that fire and smoke dampers are correctly installed and are fully opened.
  - 3.5.7 Verify that fan discharges are appropriate for the outlet ductwork with regards to the "system effect" per AMCA Publication 201. Inappropriate fan discharges will not be accepted.
  - 3.5.8 Verify proper fan rotation.
  - 3.5.9 Verify proper belt drive alignment.
  - 3.5.10 Verify fan motor overload elements are correctly sized.
  - 3.5.11 Adjust fan sheave until CFM is at or above design CFM. Provide additional sheaves and belts as required. Verify that motor is not overloaded.
  - 3.5.12 Verify that HVAC control systems are fully operational.
- 3.6 Startup Report: The Contractor shall submit the startup information required by this section to the Engineer in a typed report organized as outlined herein. The Startup Report is required to meet the written notice described herein prior to starting TAB work. TAB work will not start until the Startup Report has been submitted and approved.

END OF SECTION 23 05 90

## SECTION 23 05 91 - TESTING, CLEANING, AND STERILIZATION OF PIPING SYSTEMS

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Mechanical Materials and Methods section, and is part of each Division-23 section making reference to or requiring the testing and other procedures specified herein.
- 1.3 Notify the Architect/Engineer when system tests are ready to be witnessed at least 24 hours prior to the test.
- 1.4 All materials, test equipment, and devices required for cleaning, testing, sterilizing or purging shall be provided by the Contractor.

### 2 PRESSURE TESTS

- 2.1 General: Provide temporary equipment for testing, including pump and gauges. Test piping systems before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with indicated medium and pressurize for indicated pressure and time.
- 2.2 Required test period is four hours.
- 2.3 No piping, fixtures, or equipment shall be concealed or covered until they have been tested. The contractor shall apply each test and ensure that it is satisfactory for the period specified before calling the Architect/Engineer to observe the test. Test shall be repeated upon request to the satisfaction of those making the inspection.
- 2.4 Observe each test section for leakage at the end of the test period. Test fails if leakage is observed or if pressure drop exceeds 5% of the test pressure.
- 2.5 Check of systems during application of test pressures should include visual check for water leakage and soap bubble or similar check for air and nitrogen leakage.
- 2.6 During heating and cooling cycles, linear expansion shall be checked at all elbows and expansion joints for proper clearance.
- 2.7 Repair piping systems sections which fail required piping test. Disassemble and re-install using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- 2.8 Pressure Test Requirements:
  - 2.8.1 Soil, Waste, and Vent Test all piping within the building with a 10 foot head of water. Test piping in sections so that all joints are tested. Provide test tees as required.
  - 2.8.2 Domestic Water: Perform hydrostatic test on all piping within the building at twice the normal static pressure at service point, but not less than 100 psig. Once tested, flush out piping and leave under pressure of the supply main or 40 psig for the balance of the construction period.
  - 2.8.3 Fire Sprinkler System: Perform hydrostatic test at 200 psig.

### 3 CLEANING AND STERILIZATION

- 3.1 General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water or blowdown with air before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
- 3.2 Flush and drain all water systems at least three times. Reverse flush systems from smallest piping to largest piping. Replace startup strainers with operating strainers.
- 3.3 Sterilization of Domestic Water Systems:
- 3.3.1 Prerequisites: All new hot and cold water piping installed (complete), all fixtures connected, system flushed out, and system filled with water.
- 3.3.2 The shut off valve at the water main shall be closed, all fixture outlets opened slightly, and a sterilizing solution shall be introduced at a manifold connection installed by the Contractor at the meter.
- 3.3.3 The solution shall contain 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or calcium hypochlorite. The solution shall be allowed to stand in the system for at least eight hours after which the entire system shall be flushed.
- 3.3.4 After final flushing, all aerators shall be removed, cleaned, and reinstalled. After final flush the residual chlorine shall not exceed 0.2 parts per million.
- 3.3.5 The Architect/Engineer shall be notified 24 hours prior to the procedure so that it can be witnessed.
- 3.3.6 Provide sampling and certified report by an independent testing lab. Provide written Health Department approval of disinfection samples.

END OF SECTION 23 05 91

## SECTION 23 05 93 - TESTING AND BALANCING OF MECHANICAL SYSTEMS

### 1 GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section. Division-23 Basic Mechanical Materials Sections apply to work of this section.

### 1.2 Description of Work:

1.2.1 Extent of testing, adjusting, and balancing work (TAB) is indicated by requirements of this section, and also by drawings and schedules, and is defined to include, but is not necessarily limited to, air distribution systems, hydronic distribution systems and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required.

1.2.2 Coordination: Coordinate with the General Contractor and Mechanical Contractor responsible for the HVAC system installation as required to complete the TAB work.

1.3 The intent of this specification is to balance HVAC systems within the tolerances listed, maintaining the pressure relationships indicated, with a minimum of noise.

### 1.3.1 Airflow Tolerances:

1.3.1.1 Air Handling: The supply air, return air and outdoor air quantities shall be balanced within 5% of design values.

1.3.1.2 Exhaust Fans: The exhaust fan quantities shall be set as required to maintain the design exhaust terminal flows within 5% of design values. If no exhaust terminals exist, exhaust fan air quantities shall be balanced within 10% of design values.

1.3.1.3 Ceiling Diffusers, Supply Registers, Return and Exhaust Inlets: Balance to an air quantity within 10% of the design values.

### 1.3.2 Temperature Tolerances:

1.3.2.1 Air Handling Temperatures: The controlled temperatures at AHUs shall be verified to be under control within 1°F of design values.

1.3.2.2 Room Temperatures: Balance systems and controls within 2°F of indicated settings.

1.4 Quality Assurance: The TAB Contractor shall be located within 125 miles of the job site and certified as one of the following:

1.4.1 Tester: A firm certified by National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project, who is not the Installer of the systems to be tested and is otherwise independent of the project. Comply with NEBB's "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems" as applicable to this work.

1.4.2 Tester: A firm certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project. AABC-certified firms are independent by definition. Comply with AABC's Manual MN-1 "AABC National Standards", as applicable to this work.

1.4.3 Industry Standards: Comply with American Society of Heating, Refrigerating and Air-Conditioning



Engineers, Inc. (ASHRAE) recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated.

1.5 Job Conditions:

1.5.1 Do not proceed with testing, adjusting, and balancing work until HVAC work (including Controls) has been completed and is operable. Ensure that there is no residual work still to be completed.

1.5.2 Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

1.5.3 Do not proceed until architectural work that would affect balancing (walls, ceiling, windows, doors) have been installed.

1.5.4 Testing may proceed system by system, but each HVAC system must be complete as describe herein.

1.5.5 The mechanical contractor shall make any changes in pulleys, belts, and dampers, and/or add dampers as required for correct balancing.

1.6 Approval Submittals

1.6.1 Submit the name of the proposed test and balance company for the Engineer's approval within thirty (30) days after awarding of contract.

1.7 Test Reports and Verification Submittals:

1.7.1 Submit four (4) copies of the dated test and balance report upon completion of TAB work. The report shall include a list of instruments used for the work. The report shall be signed by the supervisor who performed the TAB work.

2 PRODUCTS

2.1 Patching Materials: Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

2.2 Test Instruments: Utilize test instruments and equipment of the type, precision, and capacity as recommended in the referenced standard. All instruments shall be in good condition and shall have been calibrated within the previous six (6) months (or more recently if required by standard).

3 EXECUTION

3.1 General:

3.1.1 Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Do not proceed with TAB work until unsatisfactory conditions have been corrected in manner acceptable to Tester.

3.1.2 Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards, and as modified or detailed herein.

3.1.3 Test, adjust and balance systems during summer season for air conditioning systems and during winter season for heating systems, including at least a period of operation at outside conditions within 5°F wet bulb temperature of maximum summer design condition, and within 10°F dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature readings when seasonal operation does permit. The Contractor shall return for a change of seasons test at no additional cost to the Owner

and submit the revised TAB report.

- 3.1.4 Punch List: Prepare a deficiency (punch)list for the Contractor with a copy of the Engineer that lists all items that are incorrectly installed or are functioning improperly. Provide a retest after all items are corrected.
- 3.1.5 Prepare TAB report of test results, including instrumentation calibration reports, in format recommended by applicable standards, modified as required to include all data listed herein.
- 3.1.6 Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.
- 3.1.7 Permanently Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.
- 3.1.8 Include in the TAB report recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.
- 3.1.9 Include an extended warranty of ninety (90) days after completion of test and balance work, during which time the Engineer, at his discretion, may request a recheck, or resetting of any component as listed in test report. The TAB company shall provide technicians and instruments and make any tests required by the Engineer during this time period.
- 3.2 Controls
  - 3.2.1 Check all HVAC controls for proper location, calibration and sequence of operation.
  - 3.2.2 Check operation of all controllers and controlled devices to verify proper action and direction. Check the operation of all interlocks.
  - 3.2.3 Check all damper motors for leakage when in closed position. If leakage is more than 5%, mechanical contractor shall reset damper linkages.
  - 3.2.4 Check all control valves for complete closure and correct action under all operating conditions.
- 3.3 Air Balancing
  - 3.3.1 Leakage tests on ductwork must have been completed before air balancing.
  - 3.3.2 Set dampers, volume controls and fan speeds to obtain specified air delivery with minimum noise level. Rebalance as required to accomplish this. Simulate fully loaded filters during test.
  - 3.3.3 Set grille deflections as noted on plans. Modify deflections if required to eliminate drafts or objectionable air movement.
  - 3.3.4 Record air terminal velocity after completion of balance work.
  - 3.3.5 Record final grille and register deflection settings if different from that specified on contract drawings.
  - 3.3.6 Record all fan speeds.
- 3.4 Data Collection:
  - 3.4.1 In addition to the data required for any specified performance tests, measure and record the temperatures, pressures, flow rates, and nameplate data for all components listed herein.
  - 3.4.2 It is the intent of this section to record data on balanced systems, under normal operating or design

conditions.

3.4.3 Temperatures:

1. Outside dry and wet bulb temperatures.
2. Dry bulb temperature in each room and at least one wet bulb temperature in each zone.
3. Inlet and outlet temperature of each heat exchange device - both fluids.

3.4.4 Pressures:

1. Suction and discharge static pressure of each fan.

3.4.5 Flow rates:

1. Flow rate through each fan.
2. Flow rate through each coil or heat exchange device.

3.4.6 Nameplate Data:

1. Complete nameplate data for all equipment.
2. Motor data to include horsepower, phase, voltage, RPM, full load nameplate current, fuse rating in disconnect switch, number or manufacturer's size designation, and ampere rating of overcurrent and low voltage protection devices in starters.

3.5 All test openings in ductwork and ductwork insulation shall be resealed in an approved manner.

END OF SECTION 23 05 93

## SECTION 23 07 13 - EXTERIOR INSULATION FOR DUCTWORK

### 1 GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.

#### 1.3 Approval Submittals:

1.3.1 Product Data: Submit producer's data sheets and installation instructions on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:

Rigid duct insulation  
Flexible duct insulation

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

### 2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Knauf, Owens-Corning, Johns Manville, Certainteed.

2.2 Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, coverings, sealers, mastic, and adhesive) with a flame spread rating of 25 or less, and a smoke-developed rating of 50 or less as tested by ANSI/ASTM 84.

2.3 Rigid Fiberglass Insulation Board: ASTM C612, Class 1 (non load bearing). Boards shall be 3 pcf density with UL rated aluminum foil vapor barrier (FSK).

2.4 Flexible Fiberglass Insulation: ASTM C553, Type I, Class B-3 (temperature less than 350°F). Duct wrap shall be 1 pcf density with UL rated aluminum foil vapor barrier (FSK).

2.5 General Purpose Mastic: Benjamin Foster 35-00 Series, Insulcoustic VIAC Mastic, Childers CP-10, or approved equal. The final selection of this product for the specific application indicated is the responsibility of the insulation supplier. The insulation system must meet the specified application.

2.6 Vapor Barrier Sealant: Benjamin Foster 30-35, Insulcoustic IC-501, 3M EC-1378, Childers CP-30, or approved equal. Provide "Low Odor" type. The final selection of this product for the specific application indicated is the responsibility of the insulation supplier. The insulation system must meet the specified application.

2.7 Adhesive: Benjamin Foster 85-20, Insulcoustic IC-205, 3M EC-35, Childers CP-82, Childers CP-89, or approved equal. The final selection of this product for the specific application indicated is the responsibility of the insulation supplier. The insulation system must meet the specified application.

2.8 Fiber-Glas Mesh: 10x10 Mesh. Foster Mastafab or equal.

### 3 EXECUTION

3.1 Insulate all rectangular supply, return and outdoor air ductwork exposed in mechanical rooms, mezzanines, fan lofts or in any finished spaces with 1½" thick rigid fiberglass insulation with vapor barrier.

3.2 Installation of Rigid Insulation:

- 3.2.1 Clean and dry ductwork prior to insulating. Butt insulation firmly together to ensure complete and tight fit over surfaces to be covered. Install insulation materials with smooth and even surfaces. Maintain integrity of aluminum vapor barrier wherever possible. Extend insulation without interruption through walls, floors and similar ductwork penetrations except where otherwise indicated.
- 3.2.2 Install with facing to the outside with a maximum of 25% compression. Butt all insulation joints firmly together. Longitudinal seam of the vapor retarder must be overlapped a minimum of 2". Staples shall be outward clinch and placed approximately 6" on center. All penetrations, joints, seams, and damage to the facing shall be sealed with glass fabric and mastic prior to system startup. For rectangular ducts over 24" wide, secure the insulation to the bottom of the duct with mechanical fasteners spaced on 12" centers to reduce sag. Do not overcompress the insulation with the retainer. Larger ducts shall be secured with fasteners on 12-inch centers and 3 inches from all edges.
- 3.2.3 Apply open mesh glass fabric embedded in vapor barrier mastic. Then apply a second coat of general purpose mastic with aluminum grey color. This finish shall be complete over all rigid insulation.
- 3.3 Insulate all supply, return and outdoor air ductwork concealed above ceilings, in chases, or elsewhere, and the backs of all ceiling supply outlets with 2" thick fiberglass blanket insulation with vapor barrier.
- 3.4 Installation of Flexible Insulation:
- 3.4.1 Insulate round elbows and fittings with wrap such that thickness is equal to adjoining duct covering. Clean and dry ductwork prior to insulating.
- 3.4.2 Adhere insulation to duct with 50 percent coverage using approved insulation adhesive applied in 6-inch wide swaths with 6-inch spaces between swaths. Additionally secure insulation with perforated pins and Tuff-Bond or by self-sticking pins with a 3/8" self-tapping screw. Space on 12-inch centers and 3 inches from all edges. Ducts up through 24" wide only require one row of pins. Ducts over 24" wide shall have pins spaced as described herein.
- 3.4.3 Lap all joints 2 inches and seal joints with 4-inch wide strips of open mesh glass fabric embedded in two coats of general purpose mastic.
- 3.4.4 Seal all punctures and breaks in aluminum vapor barrier with open mesh glass fabric and vapor barrier sealant.

END OF SECTION 23 07 13

## SECTION 23 07 16 - INSULATION FOR HVAC EQUIPMENT AND PIPING

### 1 GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 Division-23 Basic Mechanical Materials and Methods Sections apply to work of this section.

#### 1.3 Approval Submittals:

1.3.1 Product Data: Submit producer's data sheets and installation instructions on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:

Flexible unicellular piping insulation

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

### 2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Armstrong, Johns Manville, Knauf, Owens Corning, Pittsburgh Corning, U.S. Rubber, or approved equal. All products shall be asbestos-free.

2.2 Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesive) with a flame-spread rating of 25 or less, and a smoke-developed rating of 50 or less, as tested by ANSI/ASTM E84.

#### 2.3 Pipe Insulation Materials:

2.3.1 Flexible Unicellular Pipe Insulation: ASTM C534, Type I. (Tubular, suitable for use to 200°F.)

2.3.2 Staples, Bands, Wires, and Cement: As recommended by the insulation manufacturer for applications indicated.

2.3.3 Adhesives, Sealers, Protective Finishes: Products recommended by the insulation manufacturer for the application indicated.

### 3 EXECUTION

#### 3.1 General:

3.1.1 Install thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

3.1.2 Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

3.1.3 Maintain integrity of vapor-barrier on insulation and protect it to prevent puncture and other damage. Label all insulation "ASBESTOS FREE".

3.1.4 Do not apply insulation to surfaces while they are hot or wet.

- 3.1.5 Do not install insulation until systems have been checked and found free of leaks. Surfaces shall be clean and dry before attempting to apply insulation. A professional insulator with adequate experience and ability shall install insulation.
- 3.1.6 Do not install insulation on pipe systems until acceptance tests have been completed except for flexible unicellular insulation. Do not install insulation until the building is "dried-in".
- 3.2 Flexible Unicellular Pipe Insulation:
  - 3.2.1 Insulate the following piping systems:
    - 3.2.1.1 Condensate drains from air conditioning units - ½" thick.
    - 3.2.1.2 Refrigerant piping - ¾" thick.
    - 3.2.2 Apply insulation in accordance with the manufacturer's recommendations and instructions. Mitre cut insulation to fit pipe fittings. Use approved cement to seal all joints and ends in the insulation.
    - 3.2.3 Insulation outside the building shall be protected by a smooth 0.016" thickness aluminum jacket secured with aluminum bands on 12" centers.

END OF SECTION 23 07 16

## SECTION 23 31 13 - HVAC METAL DUCTWORK

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods Sections apply to work of this section.
- 1.3 Extent of HVAC metal ductwork is indicated on drawings and in schedules, and by requirements of this section.
- 1.4 Refer to other Division-23 sections for exterior insulation of metal ductwork.
- 1.5 Refer to other Division-23 sections for ductwork accessories.
- 1.6 Codes and Standards:
- 1.6.1 SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" 1985 Edition for fabrication and installation of metal ductwork, unless otherwise noted.
- 1.6.2 NFPA 90A Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
- 1.6.3 NFPA 96 Compliance: Comply with NFPA 96 "Standard for Installation of Equipment for Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment".
- 1.7 Approval Submittals:
- 1.7.1 Product Data: Submit manufacturer's technical product data and installation instructions for the following.
- Factory-fabricated ductwork  
Sealants  
Flexible duct  
Spin-in fittings  
Side take-off fittings
- 1.7.2 Shop Drawings: Submit scaled layout drawings of HVAC metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.
- ### 2 PRODUCTS
- 2.1 Ductwork Materials:
- 2.1.1 Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.



- 2.1.2 Galvanized Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality; with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations. Stamp gauge and manufacturer's identification on each sheet. Break sheets so that identification is exposed.
- 2.2 Miscellaneous Ductwork Materials:
- 2.2.1 General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- 2.2.2 Duct Sealant: Provide non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
- 2.2.3 Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork. For exposed stainless steel ductwork, provide matching stainless steel support materials.
- 2.2.4 Flexible Ducts: Provide flexible ductwork with an R-value of R-6 unless the ductwork is in a ceiling return plenum. The use of flexible ductwork for connection of supply air including terminal units and return air devices is acceptable only where shown on the drawings.
- 2.2.4.1 Construction: Provide reinforced metalized polyester jacket that is tear and puncture resistant, air tight inner core with no fiberglass erosion in the air stream and an encapsulated wire helix. Flexible ductwork shall have a recommended operating pressure of 6" w.g. for sizes 4" through 12" diameter and 4" w.g. for sizes 14" through 20" diameter. All diameters shall be suitable for a negative operating pressure of 0.75" w.g. Flexible ductwork shall meet the requirements of UL-181, the Florida Energy Code, Florida Building Code, NFPA 90A and NFPA 90B.
- 2.2.4.2 Acceptable Manufacturers: Subject to compliance with requirements, provide R-6 flexible ductwork by: Atco 36, Flexmaster 8M-R6 or Thermaflex M-KE R6.
- 2.2.5 Spin-in and Side Take-off Fittings: Provide round branch run-outs as follows.
- 2.2.5.1 Spin in air device connections shall be straight sided spin in with damper and two inch high insulation stand-off equal to Crown 3720-DS.
- 2.2.5.2 Where duct height does not permit the use of spin-in fittings, use low profile side take-off fittings equal to Crown 3300-DS or Flexmaster STOD-BO.
- 2.2.6 Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° laterals and 45° elbows for branch takeoff connections. Where 90° branches are indicated, provide conical type tees.
- 2.3 Fabrication:
- 2.3.1 Shop fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

- 2.3.2 Shop fabricate ductwork of gauges and reinforcement complying with SMACNA "HVAC Duct Construction Standards", except provide sealant at all joints. Supply duct from low pressure air conditioning units, and all return and exhaust duct shall be minimum 2" pressure class unless otherwise noted.
- 2.3.3 Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1½ times associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.
- 2.3.4 Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Ductwork Accessories" for accessory requirements.
- 2.3.5 Fabricate duct plenums with duct liner where indicated. Laminate liner to internal surfaces of duct (100% coverage) in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners (Grip Nails or Stic Klips) on 16 centers. On horizontal runs install top and bottom first and wedge sides between top and bottom. Apply a brush coat of fire retardant over all joints, visible cut edges, and leading edges to prevent erosion.
- 2.4 Factory-Fabricated Low Pressure Ductwork (Maximum 2" W.G.):
- 2.4.1 Material: Galvanized sheet steel complying with ASTM A 527, lockforming quality, with ASTM A 525, G90 zinc coating, mill phosphatized.
- 2.4.2 Gauge: 28-gauge minimum for round ducts and fittings, 4" through 8" diameter. 26-gauge minimum 9" through 14", 24-gauge minimum 15" through 26".
- 2.4.3 Elbows: One piece construction for 90° and 45° elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.
- 2.4.4 Divided Flow Fittings: 90° tees, constructed with saddle tap spot welded and bonded to duct fitting body.
- 2.4.5 Acceptable Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork by Semco Mfg., Inc. or United Sheet Metal Div., United McGill Corp, or approved equal.

### 3 EXECUTION

- 3.1 General: Examine areas and conditions under which HVAC metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- 3.2 Installation of Metal Ductwork:
- 3.2.1 General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.

- 3.2.2 Supports: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work. Install self-drilling screw anchors in prestressed concrete or existing work.
- 3.2.3 Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements. Seal joints in round or oval ductwork with hard cast or shrink bands, and sheet metal screws, or by welding. High velocity rectangular ducts shall have approved joints and be made airtight with sealer or welding.
- 3.2.4 Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally. Avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to ½" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. In finished and occupied spaces, conceal ductwork from view by locating in mechanical shafts, hollow wall construction or above suspended ceilings, unless specifically noted as "Exposed". Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- 3.2.5 Electrical Equipment Spaces: Do not route ductwork through transformer vaults or other electrical equipment spaces and enclosures.
- 3.2.6 Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1½". Fasten to duct and substrate. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate.
- 3.2.7 Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- 3.2.8 Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards. Fan discharge outlet ducts shall be installed correctly with regard to "system effect" per AMCA Publication 201.
- 3.3 Installation of Flexible Ducts:
- 3.3.1 Maximum Length: For any duct run using flexible ductwork, do not exceed 5'-0" extended length. Flexible duct shall only be allowed as detailed on the drawings.
- 3.3.2 Installation: Install in accordance with Section III of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible". Support flexible ducts to eliminate pinching and kinking which would restrict flow.
- 3.3.3 Peel back insulation and slide the inner core over the spin-in or diffuser neck, seal with duct sealant and install Panduit strap tightly. Slide insulation back over the inner core and install another Panduit strap over the insulation outer jacket. Tape is not acceptable.
- 3.3.4 Seal all exposed edges of fiberglass insulation with glassfab and mastic.
- 3.4 Leakage Tests: After each duct system is completed, test for duct leakage in accordance with

- Sections 3 and 5 of the SMACNA HVAC Air Duct Leakage Test Manual. Test pressure shall be equal to pressure class of duct, less 0.5" static pressure. Repair leaks and repeat tests until total leakage is less than 5% of system design air flow for low pressure systems and less than 1% for systems rated over 3".
- 3.5 Equipment Connections: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.
- 3.6 Clean ductwork internally free of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration. Keep ducts closed with poly during construction to prevent contamination by construction dust and debris.
- 3.7 Balancing: Refer to Division-23 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.
- 3.8 System Adjustment: Adjust the system to provide functional operation to the extent possible, and leave ready for Testing and Balancing work. It is not the intent of this section to provide final testing and balancing, but to leave the system operational with a minimum of noise.

END OF SECTION 23 31 13

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## SECTION 23 33 00 - DUCTWORK ACCESSORIES

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.
- 1.4 Refer to other Division-23 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.
- 1.5 Codes and Standards:
- 1.5.1 SMACNA Compliance: Comply with applicable portions of both SMACNA "HVAC Duct Construction Standards, Metal and Flexible" and "Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems".
- 1.5.2 UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers". Construct, test and label smoke dampers in accordance with UL Standard 555S "Leakage Rated Dampers for use in Smoke Control Systems" .
- 1.5.3 NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems" pertaining to installation of ductwork accessories.
- 1.6 Approval Submittals:
- 1.6.1 Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions as follows:
- Low pressure manual dampers
  - Control dampers
  - Duct access doors
  - Flexible connections
- 1.6.2 O&M Data Submittals: Submit manufacturer's maintenance data including parts lists for smoke dampers. Include this data, product data, and a copy of approval submittals in O&M manual.
- 2 PRODUCTS
- 2.1 Dampers:
- 2.1.1 Low Pressure Manual Dampers: Provide 16 gauge dampers of single-blade type (12" maximum blade width) or multiblade type. Damper blades to be gang-operated from a single shaft with nylon or ball bearings on each end. Provide indexed locking quadrant. Parallel or opposed blade style is acceptable. Provide 2" standoff on locking quadrant for externally insulated duct.

- 2.1.2 Control Dampers: Extruded aluminum (6063-T5) damper frame shall not be less than 0.080" in thickness. Damper frame shall be 4" deep x 1", with duct mounting flanges on both sides of frame. Damper frame shall have a 2" mounting flange on the rear of the damper when installed as Extended Rear Flange install type. Aluminum frame shall be clear anodized to a minimum thickness of 0.7 mil deep. Frame shall be assembled using stainless steel screws. Welded frames shall not be acceptable. Actuators (motors) are provided by control contractor.
- 2.1.2.1 Blades shall be maximum 6.4" deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 0.06", clear anodized to a minimum thickness of 0.7 mil deep.
- 2.1.2.2 Blade seals shall be extruded silicone, secured in an integral slot within the aluminum blade extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals will not be approved.
- 2.1.2.3 Hexagonal control shaft shall be  $\frac{7}{16}$ ". It shall have an adjustable length and shall be an integral part of the blade axle. A field-applied control shaft shall not be acceptable. All parts shall be stainless steel.
- 2.1.2.4 Linkage hardware shall be aluminum and stainless steel, installed in the frame side, out of the airstream, and accessible after installation. Linkage hardware shall be complete with stainless steel cup-point trunnion screws to prevent linkage slippage. Linkage that consists of metal rubbing metal will not be approved.
- 2.1.2.5 Dampers shall be designed for operation in temperatures ranging from -40°F to 212°F.
- 2.1.2.6 Dampers shall be AMCA rated for Leakage Class 1A at 1 in w.g. static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.
- 2.1.2.7 Dampers shall be custom made to required size, with blade stops not exceeding 1¼" in height.
- 2.1.2.8 Dampers shall be opposed blade for modulating dampers or parallel blade action for open/shut dampers.
- 2.1.2.9 Dampers shall be installed in the following manner: Installed in Duct
- 2.1.2.10 Installation of dampers must be in accordance with manufacturer's current installation guidelines, provided with each damper shipment.
- 2.1.2.11 Field supplied intermediate structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width.
- 2.1.2.12 Acceptable Manufacturers: Subject to compliance with requirements, provide dampers by Air Balance, American Warming & Ventilating, Arrow Louver and Damper, Penn Ventilator Co., or Ruskin Mfg. Co.
- 2.2 Turning Vanes: Provide manufactured or fabricated single wall turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".
- 2.3 Duct Access Doors:
- 2.3.1 General: Provide duct access doors of size indicated, or as required for duty indicated.
- 2.3.2 Construction: Construct of same or greater gauge as ductwork served. Provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors.
- 2.3.3 Acceptable Manufacturers: Subject to compliance with requirements, provide access doors by Air Balance, Inc., Greenheck., Ruskin Mfg. Co.

2.4 Flexible Connections:

- 2.4.1 General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.
- 2.4.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following: Duro Dyne Corp., Flexaust (The) Co., or Ventfabrics, Inc.

3 EXECUTION

- 3.1 Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- 3.2 Installation of Ductwork Accessories:
- 3.2.1 Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- 3.2.2 Install balancing dampers at all main ducts adjacent to units in return air, outside air and where indicated.
- 3.2.3 Install control dampers in the outside air duct and return air duct for each air handler. Damper operator provided by control contractor.
- 3.2.4 Install turning vanes in square or rectangular 90° elbows in supply, return, and exhaust air systems, and elsewhere as indicated.
- 3.2.5 Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Install on entering air side of reheat coils. Install at smoke detectors.
- 3.2.6 Install flexible connections in ductwork such that the clear length of the connector is approximately two inches. Provide thrust restraints as required. Flexible material shall not be so slack as to take a definite concave or convex shape during fan operation.
- 3.2.7 Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.
- 3.3 Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories as required to obtain proper operation and leakproof performance.
- 3.4 Adjusting and Cleaning:
- 3.4.1 Adjusting: Adjust ductwork accessories for proper settings.
- 3.4.2 Final positioning of manual dampers is specified in Division-23 section "Testing, Adjusting, and Balancing". However, the system shall be left functional with all dampers open or throttled.
- 3.4.3 Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.



END OF SECTION 23 33 00

## SECTION 23 34 00 - FANS

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of fan work required by this section as indicated on drawings and schedules, and by requirements of this section.
- 1.4 Coordination:
  - 1.4.1 Refer to Division-23 section "Testing, Adjusting, and Balancing" for balancing of fans.
  - 1.4.2 Refer to Division-23 HVAC control systems sections for control work required in conjunction with fans.
  - 1.4.3 Refer to Division-26 sections for power supply wiring from power source to power connection on fans. Division-26 work will include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
- 1.5 Codes and Standards:
  - 1.5.1 AMCA Compliance: Provide fans which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Ratings Seal.
  - 1.5.2 UL Compliance: Provide fans which are listed by UL and have UL label affixed.
- 1.6 Approval Submittals:
  - 1.6.1 Product Data: Submit manufacturer's technical data for fans, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions. Submit assembly-type drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.

Fans  
Vibration Control

- 1.7 O&M Data Submittals: Submit maintenance data and parts list for each type of fan, accessory, and control. Include these data, a copy of approved submittals, and wiring diagrams in O&M Manual.
- ### 2 PRODUCTS
- 2.1 General: Except as otherwise indicated, provide standard prefabricated fans of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation. Provide accessories as listed in the schedule on the drawings and as described herein. Motors shall be high efficiency per Division-23 section "Motors".
  - 2.2 Acceptable Manufacturers: Subject to compliance with requirements provide fans manufactured by Acme, Greenheck, Loren Cook, Penn or approved equal unless otherwise noted herein.
  - 2.3 In-Line Centrifugal Fans:
    - 2.3.1 Housing: Provide square weather tight housing constructed of aluminum or steel and painted inside

2.3.2 and out with an epoxy finish. Provide venturi type inlet. Provide heavy duty duct collars. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction. Provide two sided access panels, located perpendicular to the motor mounting plane. Provide ½" insulated housing. Provide motor and drive cover for belt drive units.

2.3.3 Fan Wheels: Provide aluminum air foil type, backward curved, statically and dynamically balanced.

2.3.4 Drive: Provide direct or belt drive as scheduled with pre-lubricated, ball bearing, continuous duty type motors. Provide vibration isolation equipment for the entire drive.

2.3.5 Isolation and Support: Provide spring type vibration isolators and fan support brackets.

2.4 Vibration Isolation: Mount fans on vibration isolators in accordance with the requirements of Division-23 section "Vibration Isolation" and the following list.

2.4.1 Hangers: Type HA2.

### 3 EXECUTION

3.1 General: Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognized industry practices to insure that fans serve their intended function.

3.2 Coordinate fan work with work of roofing, walls, and ceilings as necessary for proper interfacing. Framing of openings, caulking, and curb installation is not work of this section.

3.3 Ductwork: Refer to Division-23 section "Ductwork". Connect ducts to fans in accordance with manufacturer's installation instructions. Provide flexible connections in ductwork at fans.

3.4 Install fans on vibration isolation equipment as required. Set level and plumb.

3.5 Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.6 Remove shipping bolts and temporary supports within fans. Adjust dampers for free operation.

3.7 Testing: After installation of fans has been completed, test each fan to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

3.8 Cleaning: Clean factory-finished surfaces. Remove all tar and soil. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 23 34 00

## SECTION 23 37 13 - GRILLES, REGISTERS AND CEILING DIFFUSERS

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- 1.4 Refer to other Division-23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets and for balancing of air outlets and inlets; not work of this section.
- 1.5 Codes and Standards:
  - 1.5.1 ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual". Provide air outlets and inlets bearing ADC Certified Rating Seal.
  - 1.5.2 NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
- 1.6 Approval Submittals:
  - 1.6.1 Product Data: Submit manufacturer's technical product data for air outlets and inlets indicating construction, finish, and mounting details.
  - 1.6.2 Performance Data: For each type of air outlet and inlet furnished, provide aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections and data as required.
- 1.7 O&M Data Submittals: Submit cleaning instructions for finishes and spare parts lists. Include this data and a copy of approval submittals in O&M manual.

### 2 PRODUCTS

- 2.1 General:
  - 2.1.1 Except as otherwise indicated, provide manufacturer's standard grilles, registers, and ceiling diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
  - 2.1.2 Manufacturers not listed in the following specification will not be considered for approval unless accepted by addendum prior to bid.
  - 2.1.3 Performance: Provide grilles, registers and ceiling diffusers that have, .as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device equal to the basis of design.
  - 2.1.4 Ceiling and Wall Compatibility: Provide grilles, registers and diffusers with border styles that are compatible with adjacent wall and ceiling systems, and that are specifically manufactured to fit into ceiling module or wall with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems and walls which will contain each type of ceiling diffuser, grille, or register.

- 2.1.5 Appearance: All grilles and registers shall be aluminum construction and all diffusers shall be steel or aluminum construction, unless otherwise noted, with uniform matching appearance for each type of outlet. Ceiling mounted grilles and registers shall be set to be sight tight from the predominant exposure.
- 2.1.6 Finish: All ceiling mounted grilles, registers, and diffusers shall be finished with baked white enamel. Wall and door mounted grilles and registers shall be finished with clear anodized finish .
- 2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products by Titus, Nailor, or Metal Aire.
- 2.3 Rectangular Ceiling Diffusers: Provide rectangular face diffuser with removable inner core, and no corner joints. If square or rectangular neck is provided, provide square to round adaptor as required. Provide lay-in panel as required. Provide beveled trim ring for diffusers in hard ceilings.
- 2.4 Security Grilles (Supply and Exhaust): Steel Round Perforated Face, Suicide-deterrent security grilles designed for maximum security applications shall be of the sizes and mounting type shown on the plans and outlet schedule. Grilles shall have a 3/16-inch thick steel face and shall comply with the National Institute of Corrections guidelines for suicide prevention. The sleeve shall be 3/16-inch thick and shall be stitch-welded to the face and along the entire length of all sleeve seams. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.
- 2.5 Return, Exhaust, and Transfer Grilles : Provide return grilles and with one set of 35 degree fixed louvers, parallel to the long dimension. Provide mounting frame for all wall and plaster ceiling installations. Provide 24x24 lay in module for devices in lay in ceiling.

### 3 EXECUTION

- 3.1 Coordinate installation with ceiling and light fixture installation. Locate ceiling outlets as indicated on architectural Reflected Ceiling Plans. Unless otherwise indicated, locate ceiling outlets in the center of acoustical ceiling modules with sides parallel to the grid.
- 3.2 Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended functions.
- 3.3 Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- 3.4 Set air volumes to values shown on the drawings so that the system is functional. Leave ready for test and balance contractor.
- 3.5 Furnish to Owner three operating keys for each type of outlet and inlet that require them; obtain receipt.

END OF SECTION

## SECTION 23 37 26 - WALL LOUVERS

### 1 GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.

1.3 Extent of wall louver work is indicated by drawings and schedules, and by the requirements of this section.

1.4 Refer to other Division-23 sections for ductwork, duct accessories and controls work.

1.5 AMCA Compliance: Test and rate louvers in accordance with AMCA Standard 500. Provide AMCA certified rating seal. Ratings based on tests and procedures performed in accordance with AMCA 500-L and complying with the AMCA 511 Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance, water penetration and wind driven rain ratings.

1.6 Product Qualifications:

1.6.1 Florida Product Approved Louvers:

1. Miami-Dade County, Florida Notice of Acceptance (NOA).
2. Florida Building Code Approval.
3. Louver shall be certified to Florida Building Code Testing Application Standards TAS 100(A) (Wind Driven Rain Resistance), TAS 201 (Large Missile Impact), TAS 202 (Uniform Static Air Pressure) and TAS 203 (Cyclic Wind Loading).
4. AMCA Listed for compliance to AMCA 540 Level E and AMCA 550 standards.

1.6.2 ICC 500 Approved Louvers:

1. FEMA 361
2. ICC 500
3. Louver shall be UL classified wind-storm rated assembly to static and cyclical design pressures of positive/negative 250 psf and debris impact of a 15 lb 2x4 travelling at 100 mph.

1.7 Approval Submittals:

1.7.1 Product data: Submit manufacturer's technical product data for louvers including: model number, accessories furnished, construction, finish, mounting details, performance data.

1.8 O&M Data Submittals: Submit maintenance data, including cleaning of finishes and a copy of approval submittals. Include in O&M manual.

### 2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, submit products by Ruskin, Greenheck, Arrow, American Warming and Ventilating, or AMCA labeled approved equal.

2.2 General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation. Provide Kynar 500 coated, corrosion resistant finish and 5 year warranty; color to be selected by the Owner.

- 2.3 Substrate Compatibility: Provide Florida Product approved louvers with 3 inch frame and FEMA louvers with 5-1/2 inch frame in a common 10 gauge steel sleeve, each with flange and sill extension piece that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.
- 2.4 Materials:
- 2.4.1 Florida Product Approved Louvers: Construct of aluminum extrusions, Alloy 6063-T6 0.073" thick for frame and 0.040" thick for blades. Blades are mounted vertically and spaced 3/4" center to center. Weld units or use stainless steel fasteners.
- 2.4.2 FEMA Louvers: Frame shall be constructed of 1/4" thick aluminum. Blades shall be 3"x3"x1/4" thick inverted V style extruded aluminum.
- 2.5 Sill Flashing: Formed aluminum, 0.080" thick, upturned sides to prevent water leakage.
- 2.6 Installation Angles: Material: 1.375 x 2.25 inch x 0.125 inch thick continuous aluminum angles around louver perimeter for installation in concrete, deep CMU, steel and wood substrate wall systems.
- 2.7 Installation Plates: Material: 10 gauge steel sleeve for installation in thin CMU substrate wall systems.
- 2.8 Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.
- 2.9 Stationary Florida Product Approved Louvers: Hurricane and impact rated louvers, basis of design is Ruskin EME3625DFL .
- 2.10 FEMA Louvers: Wind-storm rated louvers, basis of design is Ruskin XP500.
- 2.11 Performance Data
- 2.11.1 EME3625DFL:
1. Performance Ratings: AMCA licensed.
    - a. Based on testing 48 inches x 48 inches size unit in accordance with AMCA 500-L.
  2. Free Area: 46 percent, nominal.
  3. Free Area Size: 7.29square feet.
  4. Maximum Recommended Air Flow through Free Area: 2,024 feet per minute.
  5. Air Flow: 10,484 cubic feet per minute.
  6. Maximum Pressure Drop (Intake): 0.60 inches w.g..
  7. Wind Load Rating: Maximum wind load of ±150 PSF.
  8. AMCA 500-L Wind Driven Rain Performance: 99.9 percent effective at preventing water penetration through louver when tested at 50 miles per hour wind with 8 inches per hour rainfall and 2,024 feet per minute airflow through the free area. Penetration Class 'A' with Discharge Class (Intake) '1' in accordance with AMCA 500-L Wind Driven Rain Test.
- 2.11.2 XP500:
1. Performance Ratings: AMCA licensed.
    - a. Based on testing 48 inches x 48 inches size unit in accordance with AMCA 500-L.
  2. Free Area: 49.8percent, nominal.
  3. Free Area Size: 7.97 square feet.
  4. Maximum Recommended Air Flow through Free Area: 2,000 feet per minute.
  5. Air Flow: 15,200 cubic feet per minute.

6. Maximum Pressure Drop (Intake): 1.0 inches w.g..
7. Water Penetration: Beginning point of water penetration of 0.01 ounce per ft<sup>2</sup> of free area shall be above 615 feet per minute free area velocity.
8. Wind Load Rating: Maximum wind load of  $\pm 250$  PSF.

3 EXECUTION

- 3.1 Install where shown on the drawings in accordance with the manufacturer's printed instruction and Florida Product Approval. Exercise care to prevent scratches.
- 3.2 Isolate dissimilar metals per the manufacturer's recommendations.
- 3.3 Verify size of louvers shown on drawings prior to fabrication. Coordinate with wall openings. Sizes may be altered subject to approval by Engineer provided free area remains approximately the same as indicated.

END OF SECTION 23 37 26



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## SECTION 23 43 18 - BI POLAR IONIZATION AIR CLEANING EQUIPMENT

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of air cleaning work required by this section is indicated on drawings and schedules, and by requirements of this section.
- 1.4 Refer to Division-23 air handling units section for filter boxes associated with air handling units; not work of this section.
- 1.5 Refer to Division-23 duct accessories section for duct access door work required in conjunction with air filters; not work of this section.
- 1.6 Refer to Division-26 sections for power supply wiring from power source to power connection on air filter units. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed by manufacturer.
- 1.7 Control wiring specified as work of Division 23 for Automatic Temperature Controls is work of that section.
- 1.8 Codes and Standards:
- 1.8.1 NFPA Compliance: Comply with applicable portions of NFPA 90A pertaining to installation of air filters.
- 1.8.2 UL Compliance: Comply with UL Standards pertaining to safety and performance of air filter units.
- 1.8.3 ASHRAE Compliance: Comply with provisions of ASHRAE Standard 52 for method of testing, and for recording and calculating air flow rates.
- 1.9 Approval Submittals:
- 1.9.1 Product Data: Submit manufacturer's technical product data including dimensions, weights, required clearances and access, flow capacity including initial and final pressure drop at rated air flow, efficiency and test method, fire classification, and installation instructions.
- BiPolar Ionization
- 1.9.2 Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, materials, and methods of assembly of components.
- BiPolar Ionization
- 1.10 Test Reports and Verification Submittals:
- 1.10.1 Submit HEPA filter test reports.
- 1.11 O&M Data Submittals:
- 1.11.1 Maintenance Data: Submit maintenance data and spare parts lists for each type of filter and rack required. Include this data, product data and a copy of approval submittals in O&M manual.

- 1.11.2 Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to air filter units. Submit manufacturer's ladder-type wiring diagram for control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed. Include in O&M manual.

## 2 PRODUCTS

### 2.1 BIPOLAR IONIZATION SYSTEM

- 2.1.1 The Air Purification System shall be a product of an established manufacturer within the USA.
- 2.1.2 A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.
- 2.1.3 Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. "Plasma" particulate filters shall not be acceptable.
- 2.1.4 Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2016 to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted. The manufacturer shall provide independent test data on a previous installation performed within the last two years and in a similar application, that proves compliance to ASHRAE 62 and the accuracy of the calculations.
- 2.1.5 The Air Purification System have been tested by UL or Intertek/ETL to prove conformance to UL 867-2007 including the ozone chamber testing and peak ozone test for electronic devices. Manufacturers that achieved UL 867 prior to December 21, 2007 and have not been tested in accordance with the newest UL 867 standard with the ozone amendment shall not be acceptable. All manufacturers shall submit their independent UL 867 test data with ozone results to the engineer during the submittal process. All manufacturers shall submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.
- 2.1.6 The maximum allowable ozone concentration per the UL 867-2007 chamber test shall be 0.007 PPM. The maximum peak ozone concentration per the UL 867-2007 peak test as measured 2 inches away from the electronic air cleaner's output shall be no more than 0.0042 PPM. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.
- 2.1.7 Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of twelve months after shipment or eighteen months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

### 2.1.8 General

The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be of the manufacturer specified.

Basis of Design: Global Plasma Solutions

Approved equals by Airgenics, Active Air Solutions, and Plasma Air subject to specification compliance. All other Suppliers of comparable products requesting prior approval shall:

Submit for prior approval in accordance with the requirements of Mechanical General.

In addition, manufacturers submitting for prior approval for Bi-Polar Ionization must as part of the prior approval request provide their ASHRAE 62.1-2016 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their

calculations are ASHRAE compliant. A third party validation study performed on a previous installation of the same application shall also be included.

Submit independent test data from ETL or UL showing ozone levels produced during the UL 867 ozone chamber test. Manufacturers without this test data shall not be acceptable.

2.1.9 Bi-Polar Ionization Design & Performance Criteria: Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.

2.1.10 The Bi-polar Ionization system shall be capable of:

Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).

Controlling gas phase contaminants generated from human occupants, building structure and furnishings.

Capable of reducing static space charges.

Increasing the interior ion levels, both positive and negative, to a minimum of 800 ions/cm<sup>3</sup> measured 5 feet from the floor.

2.1.11 The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable.

Air exchange rates may vary through the full operating range of a constant volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.

Velocity Profile: The air purification device shall not have maximum velocity profile.

2.1.12 Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.

2.1.13 Equipment Requirements:

Electrode Specifications (Bi-polar Ionization):

Each Plasma Generator with Bi-polar Ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity. A minimum of one electrode pair per 2400 CFM of air flow shall be provided. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, performance output reduction over time, ozone production and corrosion.

Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating. Internal circuitry shall be provided to sense air flow across the electrode output. Ionization systems requiring the use of a mechanical air pressure switch to cycle the electrodes only when the fan is operating shall not be acceptable due to high failure rates and pressure sensitivity.

2.1.14 Air Handler Mounted Units: Plasma Generator(s) shall be supplied and installed. The plasma generator shall accept 120V power and the plasma generator company shall provide a 12V DC power supply to the control panel. The unit shall be designed with a stainless steel casing, integral illuminated on/off switch, two 2.5mm DC power jacks, high voltage output indication light and dry contacts to prove ion output is operating properly. The dry contacts shall close to prove the ion generator is working properly and may be daisy chained in series such that only one dry contact per AHU is required to interface to the

BAS or the optional DDC controller. Dry contacts proving power has been applied in lieu of the ion output is actually operating, are not acceptable.

- 2.1.15 Ionization Requirements: Plasma Generators with Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided for all equipment listed above. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by DC power or 24VAC or 110VAC to 240VAC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.

**Ionization Output:** The ionization output shall be controlled such that an equal number of positive and negative ions are produced. Imbalanced levels shall not be acceptable.

Ionization output from each electrode shall be a minimum of 15 million ions/cc when tested at 2" from the ionization generator.

All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:

MRSA - >96% in 30 minutes or less

E.coli - > 99% in 15 minutes or less

TB - > 69% in 60 minutes or less

Manufacturers not providing the equivalent space kill rates shall not be acceptable. All manufactures requesting prior approval shall provide to the engineer independent test data from a NELEC accredited independent lab confirming kill rates and time meeting the minimum requirements stated in section 2.2 B, points 6A, 6B and 6C. Products tested only on Petri dishes to prove kill rates shall not be acceptable.

- 2.1.16 Ozone Generation: The operation of the electrodes or Bi-polar ionization units shall conform to UL 867-2007 with respect to ozone generation. There shall be no ozone generation during any operating condition, with or without airflow.

- 2.1.17 Electrical Requirements: Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 24 VAC or 100 VAC to 240VAC, 1 phase, 50/60 Hz.

- 2.1.18 The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

- 2.1.19 Control Requirements:

All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset.

Integral airflow sensing shall modulate the Plasma output as the air flow varies or stops.

A mechanical air flow switch shall not be acceptable as a means to activate the Plasma device due to high failure rates and possible pressure reversal.

The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown on the plans. The contractor shall follow all manufacturer IOM instructions during installation.

### 3 EXECUTION

- 3.1 General: Comply with installation requirements as specified elsewhere in these specifications pertaining to air filters housing/casings, and associated supporting devices.

3.2 AIR PURIFICATION SYSTEM

3.2.1 General: The Contractor shall be responsible for maintaining all air systems until the owner accepts the building (Owner Acceptance).

3.2.2 Assembly & Erection: Plasma Generator with Bi-Polar Ionization

All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and engineer.

Any material damaged by handling, water or moisture shall be replaced, by the mechanical contractor, at no cost to the owner.

All equipment shall be protected from dust and damage on a daily basis throughout construction.

3.2.3 Testing: Provide the manufacturers recommended electrical tests.

3.2.4 Commissioning & Training: A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

3.3 Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

END OF SECTION 23 43 18

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## SECTION 23 81 26 - AIR SOURCE UNITARY SPLIT SYSTEM HEAT PUMP UNITS

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Refer to other Division-23 sections for testing, adjusting, and balancing of air conditioning units (AHUs).
- 1.4 Approval Submittals:
  - 1.4.1 Product Data: Submit manufacturer's technical product data, including dimensions, ratings, electrical characteristics, weight, capacities, materials of construction, and installation instructions.
    - 1.4.1.1 Split system units
    - 1.4.1.2 Vibration Isolation
- 1.5 O&M Data Submittals: Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals, product data, and wiring diagrams in O&M manual.

### 2 PRODUCTS

- 2.1 Quality Assurance:
  - 2.1.1 Provide units tested by UL, ARL or ETL.
  - 2.1.2 Construct refrigeration system in accordance with ASHRAE 15 (ANSI B 9.1) "Safety Code for Mechanical Refrigeration".
  - 2.1.3 Test and rate AHUs in accordance with the applicable ARI standards and provide certified rating seal. Sound test and rate units in accordance with ARI 270.
  - 2.1.4 Provide units with an EER or SEER that meets the Florida Energy Efficiency Code and the schedules on the drawings.
  - 2.1.5 Acceptable Manufacturers: Subject to compliance with requirements provide units by: Carrier, Trane, Lennox, York or approved equal.
- 2.2 General:
  - 2.2.1 Units shall be factory-assembled, wired and tested. All controls shall be factory-adjusted and preset to the design conditions.
  - 2.2.2 Casings: Construct of heavy gauge steel (or aluminum) formed panels rigidly reinforced and braced. Each unit shall be provided with removable panels to permit the unit (including fans and compressors) to be properly maintained and serviced. Entire casing shall be painted with factory-applied finish. Casing for outdoor units shall be provided with weatherproof construction with all seams bolted. Provide stainless steel hardware.
  - 2.2.3 Supports: Provide concrete pad 4" larger than the unit on all sides.



2.3 Condensing Unit:

2.3.1 Condenser Fans and Drives: Fan shall of rustproof construction: hot-dipped galvanized steel, stainless steel or aluminum. Unit shall have a variable speed motor suitable for the duty indicated. Provide a close fretwork galvanized steel or non-ferrous fan and guard. Motors shall be the permanently lubricated type, resiliently mounted.

2.3.2 Condenser Coil: Construct of copper nonferrous nonferrous tubes and copper nonferrous fins. Provide inlet guard to protect condenser fins. Provide seacoast or heresite coating on the condenser coil.

2.3.3 Compressor: Shall be scroll hermetic or semi-hermetic reciprocating design for R410a refrigerant with vibration isolation. Each compressor shall have separate refrigerant circuit. Motors shall be ball bearing, high starting torque, low starting current type for compressor service. Compressors shall not produce objectionable noise or vibration inside the building. Compressors shall have five (5) year warranty. Provide dual compressor machines if scheduled.

2.3.4 Service Valves: Provide for high and low pressure readings.

2.4 Evaporator Unit:

2.4.1 Interior of unit shall be thermally and acoustically insulated with minimum R=4.2 insulation. Provide aluminum inner liner. Provide removable panels to permit the unit to be properly serviced and maintained.

2.4.2 The evaporator shall include centrifugal fan, fan motor, direct drive vee belt drive, cast-iron sheaves, vari-pitch fan motor sheave, and lubricated bearings. Motors shall be high efficiency type as per Division-23, Basic Mechanical Materials and Methods section, "Motors". Provide cooling coils constructed of copper nonferrous tubes and copper aluminum fins. Provide seacoast or heresite coating on the coils. Filters and coils shall be selected for a maximum face velocity of 500 fpm. Provide thermal expansion valve, sight glass, refrigerant drier, strainer, controls and other necessary devices for a completely automatic unit.

2.4.3 Each unit shall be equipped with sloped IAQ drain pans under the entire evaporator coil to prevent condensate carry-over.

2.5 Electric Heater Section:

2.5.1 Provide electric heating coils controlled by one or more magnetic contactors. Three phase coils shall be wired for balanced current in each wire, if possible. Furnish and install necessary overheating and air flow controls to meet the requirements of the National Electric Code. Provide built-in air flow switch and heater interlock relay.

2.5.2 Heaters shall be factory mounted and wired with all required fuses and contactors to provide single point connection.

2.6 Unit Controls:

2.6.1 All safety and operational controls shall be factory wired.

2.6.2 Safety and Operational Control Features:

Internal compressor overtemperature protection.  
Crankcase heaters.  
Individual motor overcurrent protection.

- High pressure cutout.
  - Low pressure cutout.
  - Anti-recycle timer (5 minute)
  - Timer-type defrost control.
  - Phase failure and low voltage protection.
  - Liquid line solenoid.
- 2.6.3 Room thermostat shall be low voltage, remote-mounted with sub-base and thermometer for controlling heating and cooling cycles. The fan selector shall include "AUTO-ON" controls. The system selector shall include "OFF-COOL-HEAT-EM HT" controls. Provide automatic changeover thermostats with fan that run continuously. The room thermostats shall be manually adjustable by occupants and shall indicate setting and temperature in degrees Fahrenheit. Provide two heating stages.
- 2.6.4 Outdoor air thermostat shall energize electric heat below 35° F on call for heating by second stage of room thermostat.
- 2.6.5 Emergency heat switch shall allow operation of all electric heat.
- 2.6.6 Smoke Detector Operation: Duct-mounted smoke detectors are provided by Division-26 in the supply air stream where indicated that stop the AHU and heater when actuated.
- 2.7 Refrigerant Piping:
- 2.7.1 Copper tubing ¾" and smaller: Type ACR, hard-drawn temper tubing; wrought-copper, solder-joint fitting; brazed joints.
- 2.7.2 Copper tubing 1" - 4c": Type ACR, hard-drawn temper tubing; wrought-copper, solder-joint fitting; brazed joints.
- 2.7.3 Silver solder material: Silver solder bearing at least 15% silver; Sil Fos.
- 2.8 Basic Vibration Isolation: Provide vibration isolation products complying with Division-23 section "Vibration Isolation" and the following list:
- 2.8.1 Equipment Mounting: Type EM1
- 3 EXECUTION
- 3.1 Installation: Install in accordance with producer's printed instructions. Brush out fins on all coils.
- 3.2 Support: Mount units on concrete pads with manufacturer's recommended service and operating clearance.
- 3.3 Mount units on vibration isolation and concrete pads.
- 3.4 Brush out fins on all coils.
- 3.5 Refrigerant Piping: Comply with ANSI B31.5, "Refrigerant Piping," (except lower pressure limits below 15 psig), and ASHRAE 15 (ANSI B9.1). Make all joints carefully and neatly. Clean pipe and fittings before fluxing. Remove burrs. Braze by the sweat method using Sil Fos. Install field installed refrigerant devices and valves as required.
- 3.6 Testing: After job erection, or modification of factory installed piping, pressure test for leaks at 150 psig using a nominal amount of a suitable tracer refrigerant and dry nitrogen or a suitable

- refrigerant. Perform leak tests with an electronic halide leak detector having a sensitivity of at least ½ ounce R-12 per year. Refrigeration piping will not be accepted unless it is gas tight.
- 3.7 Evacuation: After completing the successful pressure test, multiple-evacuate the system. Leave the compressor isolation valves shut and connect the vacuum pump to both the high and low sides. Evacuate the system to an absolute pressure of 1,500 microns. Then break vacuum to 2 psig with dry nitrogen. Repeat this process. Install the proper biflow drier in the liquid line and evacuate the system to 500 microns. Leave vacuum pump running for at least two hours without interruption. Break vacuum with the refrigerant to be used and raise pressure to 2 psig. Do not operate compressors during the evacuation procedure.
- 3.8 Charging: After completing the successful evacuation procedure, charge refrigerant directly to the system from the original containers through a filter drier. Charge to the manufacturer's stated conditions of pressure for required temperature. Weigh the refrigerant added and record on the startup report.
- 3.9 Construction Filters: Provide 1" thick filters in all units during construction. After construction (but prior to the test and balance being performed) install clean final filters.
- 3.10 Cleaning: Clean tar and all other soil from housing exterior. Leave ready for Division 7, Caulking Work. Caulk around pipe sleeves.
- 3.11 Condensate Drain: Pipe trapped copper condensate drain (full size of unit outlet) to nearest floor drain or as shown on the drawings. Refer to Division-23 section "Insulation" for pipe insulation.
- 3.12 Startup: Check entire assembly for correctness of installation, alignment, and control sequencing. Start all component parts in proper sequence. Make all adjustments required to insure proper smooth quiet operation.

END OF SECTION 23 81 26

## SECTION 23 81 28 - DUCTLESS SPLIT SYSTEM AIR CONDITIONING UNITS

### 1 GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Refer to other Division-23 sections for testing, adjusting, and balancing of units; not work of this section.
- 1.4 Approval Submittals:
  - 1.4.1 Product Data: Submit manufacturer's technical product data, including dimensions, ratings, electrical characteristics, weight, capacities, materials of construction, and installation instructions. Submit assembly-type drawings showing all piping and electrical connections and all mounting requirements. Show methods of fastening and assembly of components. Provide wiring diagrams.
  - 1.5 O&M Data Submittals: Submit manufacturer's maintenance data including parts lists. Include these data, product data, and a copy of approval submittals in O&M manual.

### 2 PRODUCTS

#### 2.1 Quality Assurance:

- 2.1.1 Test and rate split system air conditioning units in accordance with ARI Standard 210, 240 or 360 as applicable, and provide certified rating seal.
- 2.1.2 Construct refrigeration system of split system air conditioning units in accordance with ASHRAE 15 (ANSI B 9.1) "Safety Code for Mechanical Refrigeration".
- 2.1.3 Provide split system air conditioning units with an SEER that meets the Florida Energy Efficiency Code and the schedule on the drawings.
- 2.1.4 Provide split system air conditioning units that are designed, manufactured, and tested in accordance with UL or ETL requirements.
- 2.1.5 Acceptable Manufacturers: Submit to compliance with requirements, provide units by Daikin, Carrier, Freidrich Mitsubishi, Trane, or approved equal.

#### 2.2 General:

- 2.2.1 Casings: Construct of painted mill galvanized steel (or aluminum) formed panels rigidly reinforced and braced. Each unit shall be provided with removable panels to permit the unit (including fans and compressors) to be properly maintained and serviced.

#### 2.3 Condensing Unit:

- 2.3.1 Condenser Fans and Drives: Fan shall be of rustproof construction, hot dipped galvanized steel, stainless steel or aluminum. Unit shall have weather protected totally enclosed motor. Provide a close fretwork galvanized steel or non-ferrous fan guard. Motors shall be the permanently lubricated type, resiliently mounted.
- 2.3.2 Condenser Coil: Construct of non-ferrous tubes and aluminum fins. Provide inlet guard to protect condenser fins.

- 2.3.3 Compressor: Shall be twin rotary inverter driven with vibration isolation. Compressor shall not produce objectionable noise or vibration inside the building. Compressors shall have seven (7) year warranty.
- 2.3.4 Service Valves: Provide for high and low pressure readings.
- 2.3.5 Seacoast Protection: Provide phosphate coating and acrylic enamel coating for external outer panels. Provide epoxy resin coating for fan motor support, separator assembly, and valve bed. Provide zinc-nickel coated and polyvinylidene chloride coating on fasteners. Provide anti-corrosion treatment to condenser coil to protect from airborne contaminants.
- 2.4 Evaporator Unit:
- 2.4.1 Interior of unit shall be thermally and acoustically insulated with 1 inch fiberglass duct liner insulation. Provide removable panels to permit the unit to be properly serviced and maintained.
- 2.4.2 The evaporator section shall include centrifugal fan, two-speed fan motor, and direct drive. Provide cooling coil, snap out washable filters, refrigerant drier, controls and other necessary devices for a completely automatic unit. Coils shall have copper tubes and aluminum fins. Provide automatic oscillating louver action to facilitate air distribution.
- 2.5 Controls:
- 2.5.1 All safety and operational controls shall be factory wired.
- 2.5.2 Provide remote microprocessor-based controls with room thermostat, timer and fan speed switch.
- 2.6 Refrigerant Piping:
- 2.6.1 Copper tubing 3/4" and smaller: Type ACR, soft annealed temper; cast copper-alloy fittings for flared copper tubes; flared joints.
- 2.6.2 Brazing material: Silver solder bearing at least 15% silver; Sil Fos.
- 3 EXECUTION
- 3.1 Installation: Install in accordance with producer's printed instructions.
- 3.2 Refrigerant Piping: Comply with ANSI B31.5, "Refrigerant Piping," (extend lower pressure limits below 15 psig), and ASHRAE 15 (ANSI B9.1). Make all joints carefully and neatly. Clean pipe and fittings before fluxing. Remove burrs. Braze by the sweat method using Sil Fos.
- 3.3 Testing: After job erection, pressure test for leaks at 150 psig using a nominal amount of a suitable tracer refrigerant and dry nitrogen or a suitable refrigerant. Perform leak tests with an electronic halide leak detector having a sensitivity of at least 1/2 ounce R-12 per year. Refrigeration piping will not be accepted unless it is gas tight.
- 3.4 Evacuation: After completing the successful pressure test, multiple-evacuate the system. Leave the compressor isolation valves shut and connect the vacuum pump to both the high and low sides. Evacuate the system to an absolute pressure of 1,500 microns. Then break vacuum to 2 psig with dry nitrogen. Repeat this process. Install the proper biflow drier in the liquid line and evacuate the system to 500 microns. Leave vacuum pump running for at least two hours without interruption. Break vacuum with the refrigerant to be used and raise pressure to 2 psig. Do not operate compressors during the evacuation procedure.
- 3.5 Charging: After completing the successful evacuation procedure, charge refrigerant directly to the system from the original containers through a filter drier. Charge to the manufacturer's stated conditions of pressure for required temperature. Weigh the refrigerant added and record on the

startup report.

- 3.6 Cleaning: Clean tar and all other soil from housing exterior. Leave ready for Division 7, Caulking Work. Caulk around pipe sleeves.
- 3.7 Condensate Drain: Pipe trapped copper condensate drain to outside the building or to a point of disposal as shown on the drawings. Pipe shall be full size of unit outlet. Refer to Division-23 section "Insulation" for pipe insulation.
- 3.8 Startup: Check entire assembly for correctness of installation, alignment, and control sequencing. Start all component parts in proper sequence. Make all adjustments required to insure proper smooth quiet operation.

END OF SECTION 23 81 28

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## **SECTION 26 05 00 - ELECTRICAL GENERAL REQUIREMENTS**

### PART 1 - GENERAL

#### 1.1 SUMMARY

The Electrical General Requirements are supplementing and applicable to Division 26 Sections and shall apply to all phases of work specified herein, shown on the Drawings, or required to provide a complete installation of electrical systems. Section 26 is sub-divided for convenience only.

- A. This Section includes the following:
1. Job Conditions
  2. Regulatory Requirements
  3. Electrical equipment coordination and installation.
  4. Submittals, Operating and Maintenance instructions and As-built drawings.
  5. Common electrical installation requirements.
  6. Warranty of work.

#### 1.2 JOB CONDITIONS:

- A. Site Inspections: Before submitting proposals, each bidder should visit the site and fully familiarize himself with all job conditions and shall be fully informed as to the extent of his work. No consideration will be given after bid opening date for alleged misunderstanding as to the requirements of work involved in connecting to the utilities or as to requirements of materials to be furnished. The contractor shall contact the utility prior to bid and make appropriate provisions in such bid as required by the utility for the utility's routing and connection.
- B. Scheduled Interruptions: Planned interruptions of utilities service, to any facility affected by this contract, shall be carefully planned and approved by Architect at least ten (10) days in advance of the requested interruption. The Contractor shall not interrupt services until the Architect has granted specific approval. The request shall indicate services to be affected, date and time of interruption and duration of outage. Request for interruption of service will not be approved until all equipment and materials required for the completion of that particular phase of work are on the job site. The work may have to be scheduled after normal working hours.
- C. Accidental Interruptions: All excavation and/or remodeling work required shall be performed with care so as not to interrupt other existing services (water, gas, electrical, sewer, sprinklers, etc.). If accidental utility interruption resulting from work performed by the Contractor occurs, service shall be immediately restored to its original condition without delay, by and at the expense of the Contractor, using skilled workmen of the trade required.

#### 1.3 REGULATORY REQUIREMENTS:

- A. Permits, Fees, and Inspections: This Contractor shall secure and pay for all permits, and inspections required on work performed under this section of the Specifications. He shall assume full responsibility for all assessments and taxes necessary for the completion and acceptance of the work. The Owner will arrange for utility power including any impact fees.
- B. Applicable Standards and Codes: The electrical installation shall comply with all applicable building codes; local, state, and federal ordinances. In case of a discrepancy among these applicable regulatory codes and ordinances, the most stringent requirement shall govern. The Contractor shall



notify the Architect in writing of any such discrepancy. Should the Contractor perform any work that does not comply with the applicable regulatory codes and ordinances he shall bear all cost arising in correcting the deficiencies. Application standards and codes shall include all local ordinances, all state laws, and the applicable requirements of the following:

1. American National Standards Institute - ANSI
2. National Electrical Manufacturer's Association - NEMA
3. National Fire Protection Association – NFPA (latest editions)
4. The National Electric Code – NEC – NFPA 70, 2020
5. The Life Safety Code – NFPA 101, 2021
6. The National Fire Alarm Code – NFPA 72, 2019
7. Florida Building Code, 2023 Edition
8. Underwriters' Laboratories, Inc. – UL

- C. Drawings and Specifications: The drawings and these specifications are complementary each to the other. What is called for by one shall be as binding as if called for by both. Omissions from the drawings and specifications of details of work which are evidently necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such work. In any case of discrepancy in the figures or catalog numbers, the matter shall be submitted to the Architect, who shall promptly make a determination in writing. Any adjustment by the Contractor shall be at the Contractor's own risk and expense. Electrical drawings are diagrammatic only. Do not scale these drawings. All equipment shall be installed in accordance with manufacturer's recommendations and any conflicting data shall be verified before bidding.
- D. The Contractor shall after completion of the work, furnish the Architect a certificate of final inspection and approval from the applicable local inspection department. The Contractor shall also make necessary changes to plans and specifications to meet code standards at no additional cost to the Owner.

#### 1.4 COOPERATION:

- A. Interfacing with Other Crafts: It shall be the responsibility of the Contractor to cooperate and coordinate with all other crafts working on this project. This Contractor shall do all cutting, trenching, backfill and structural removals to permit entry of the electrical system components. The General Contractor shall do all patching and finishing.
- B. Equipment Furnished Under Other Sections: This Contractor shall furnish and install, complete electrical roughing-in and connections to all equipment furnished under other sections and indicate on drawings. This includes all outlets as shown on mechanical and electrical drawings. All such equipment shall be set in place as work of other sections.
- C. Heating and Air Conditioning:
1. The Contractor shall furnish all branch circuit wiring to motors and control panels or centers including disconnects, receptacles, switches, and appurtenances to which the system at the units may be connected, to provide a complete system of wiring for power. Control equipment and control circuit wiring is specified in the Mechanical Section.
  2. Control devices to be included in the branch circuit, except those furnished integrals with the equipment, will be delivered by the Heating and Air Conditioning Contractor and installed by the Electrical Contractor.

#### 1.5 WORKMANSHIP:

- A. All work shall be executed in a neat and substantial manner by skilled workman, well qualified, and regularly engaged in the type of work required. Substandard work shall be removed and replaced by the Contractor at no cost to the Owner.

1.6 APPROVAL OF MATERIALS AND EQUIPMENT:

- A. Prior-Submittals: The Contractor shall base his proposal on the materials specified herein and on the drawings. Reference to a particular product by manufacturer, trade name, or catalog number establishes the quality standards of material and equipment required for this installation and is not intended to exclude products equal in quality and similar design. The Specifying Engineer reserves the sole right to decide the equality of materials proposed for use in lieu of these specified. It shall be the Contractor's responsibility to furnish the information and data sufficient to establish the quality and utility of the items in question, including furnishing of samples if required. If other equipment manufacturers determine that their equipment will fit in the space and meet the recommended clearances, suit all job conditions, equal or exceed the quality of the specified items, then a request may be made in writing to the Specifying Engineer at least ten (10) business days prior to bid date for permission to be included in the approved equipment list. All data required for evaluation shall accompany the above letter. The Specifying Engineer offers two submittal reviews, if these are unacceptable, only an "as-specified" submittal will be accepted. In addition, all value engineering alternates should only be submitted when directly requested by the owner and must be noted specifically as "VE" alternates to the items specified in the construction documents. A letter from the owner directing the VE effort is strongly encouraged as an accompaniment to any VE submittal.

B. Submittals:

1. Submittals: The Contractor shall submit a list of equipment proposed for installation. Catalog data and shop drawings on all proposed systems and their components shall be submitted. Where substitutions alter the design or space requirements, the Contractor shall defray all items of cost for the revised design and construction including costs to all allied trades involved. Provide six (6) copies of submittals and shop drawings as a minimum unless the General Conditions requires a greater number of copies. In lieu of paper copies, the Contractor may submit the submittals in PDF format.
  - a. Submittals Schedule: Submittals shall be submitted within thirty (30) days after the contract is awarded. It is not the responsibility of the Engineer to expedite the review of submittals if the contractor has not adequately prepared the submittals in a time efficient manner. The contractor bears all the responsibility for the added time requirements of resubmittals.
  - b. Identification: Place a permanent label or title block on each submittal for identification. Each major section of submittals such as power equipment, lighting equipment, fire alarm, etc., shall be secured together in a booklet or stapled with a covering index. The different parts of the submittal shall describe which Specification Section it is referenced. The covering index shall list the following information:
    - 1) Project name and date
    - 2) Name, address, and phone number of General contractor and project manager.
    - 3) Name, address, and phone number of Sub-contractor and project manager.
    - 4) Supplier of equipment with phone number and person responsible for this project.
    - 5) Index of each item covered in submittal and model number.
    - 6) Any deviation from contract documents shall be specifically noted on submittal cover index and specifically identified with highlighting, encircling, or boldly on specific submittal sheet.
  - c. The submittal shall not be in individual parts per each Specification Section but be combined as a part of a major section such as power equipment, lighting equipment, fire alarm, methods, etc.

- d. Resubmittals: The Specifying Engineer will participate in two resubmittal reviews. After the second resubmittal review, the Engineer shall not review the submittal until the Contractor provides \$1,000 to the Engineer to perform each additional required resubmittal review. Make resubmittals in same form and number of copies as initial submittal.
  - 1) Include previous submittal review comments.
  - 2) For each item being resubmitted, include previous review comment and explain how resubmitted item meets the criteria of the previous review comment.

2. Electrical and Mechanical/Plumbing/Fire Protection Equipment Coordination:

The electrical power equipment submittals shall be accompanied by a letter verifying coordination of electrical services for all mechanical, plumbing, and fire protection equipment requiring power. The letter shall follow the format listed below.

To: \_\_\_\_\_  
 (General Contractor)

Re: \_\_\_\_\_  
 (Project name and location)

We the undersigned subcontractors certify that we have coordinated the electrical requirements for mechanical, plumbing, and fire protection sprinkler equipment as evidenced by the coordination chart listed herein.

Item	Load Full Load Amps	1 Phase or 3 Phase	Number of Electrical Connections	Maximum Overcurrent Protection	Minimum Overcurrent Protection	Breaker Proposed	Circuit Proposed

The above list details all required electrical connections for mechanical equipment.

Signed: \_\_\_\_\_

For: \_\_\_\_\_  
 Mechanical Subcontractor

The above list details all required electrical connections for plumbing equipment.

Signed: \_\_\_\_\_

For: \_\_\_\_\_  
 Plumbing Subcontractor

The above list details all required electrical and fire alarm connections for fire protection equipment.

Signed: \_\_\_\_\_

For: \_\_\_\_\_  
Fire Protection Sprinkler Subcontractor

The above list of equipment has been reviewed and the required connections are being provided. (Any exceptions or request for direction shall be listed here)

Signed: \_\_\_\_\_

For: \_\_\_\_\_  
Electrical Subcontractor

#### 1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protection: Take necessary precautions to protect all material, equipment, apparatus and work from damage. Failure to do so to the satisfaction of the Architect will be sufficient cause for the rejection of the material, equipment or work in question. Contractor is responsible for the safety and good condition of the materials installed until final acceptance by the owner.
- B. Cleaning: Conduit openings shall be capped or plugged during installation. Fixtures and equipment shall be tightly covered and protected against dirt, moisture, chemical and mechanical injury. At the completion of the work the fixtures, material and equipment shall be thoroughly cleaned and delivered in condition satisfactory to the Architect.

#### 1.8 TESTING AND BALANCING:

Make tests that may be required by the Owner or the Architect in connection with the operation of the electrical system in the buildings. Balance all single-phase loads connected to all panelboards in the buildings to insure approximate equal divisions of these loads on the main secondary power supply serving the buildings. All tests shall be made in accordance with the latest standards of the IEEE and the NEC. The installation shall be tested as defined in the 26 specifications. Contractor shall perform circuit continuity and operational tests on all equipment furnished or connected by Contractor. The tests shall be made in the presence of the Architect or his representative. The Contractor shall notify the Architect at least twenty-four (24) hours in advance of tests. The Contractor shall provide all testing equipment and all costs shall be borne by him. Written reports shall be made of all tests and shall be made available at the Pre-Final Inspection. All faults shall be corrected immediately.

- A. A letter shall be written giving the following:
  - 1. Measured amps on each phase of each panel.
  - 2. Resistance to ground of each new grounding electrode.
  - 3. Measured voltage phase to phase and phase to neutral at each panel.
  - 4. Ground continuity and polarity instrument used.

#### 1.9 OPERATING AND MAINTENANCE INSTRUCTIONS/AS BUILT DRAWINGS:

- A. Four (4) complete sets of instructions containing the manufacturer's Operating and Maintenance (O&M) instructions for each piece of equipment shall be furnished to the Owner. Each set shall be permanently bound and shall have a hard cover. One complete set shall be furnished at the time that the test procedure is submitted, and remaining sets shall be furnished before the Contract is completed. Flysheets shall be placed before instructions covering each subject. The instruction sheets shall be approximately 8-1/2" by 11" with large sheets of Drawings folded in. The instructions

shall include information for major pieces of equipment and systems. In addition, a CD shall be provided to the Owner with the O&M Manuals and Drawings contained therein.

- B. Upon completion of the work and at the time designated, the services of one project engineer shall be provided by the Contractor to instruct the representative of the Owner in the operation and maintenance of the systems.
- C. This Contractor shall provide as-built Drawings at the completion of the job. Drawings shall show all significant changes in equipment, wiring, routing, location, etc. All underground conduit routing shall be accurately indicated with locations dimensioned. As-built drawings shall be submitted for review as red-lined on a field hard copy. After review by the Architect, the Contractor will be given digital AutoCAD files and shall make revisions and resubmit final on disk.
- D. All signals, communications, data, control, dimming systems, etc. shall be included in the As-Built drawings. Where electrical drawings contain a large number of items that prevent easy discernment of the As-Built system, enlarged details or other graphic methods shall be used to clarify the identification required for As-Built usage.
- E. As-Built drawings shall include the following information:
  - 1. Stub-out locations dimensioned from permanent building lines.
  - 2. Routing of all main feeders and identified as under slab, in slab, above ceiling, etc. also for lighting and power branch circuits the number of conductors shall be included, and for feeders and motor branch circuits the number, size, and insulation of conductors shall be included.
  - 3. Corrected panel board and equipment schedules.
  - 4. Corrected circuit numbers as they appear on the panel board directories.
  - 5. Corrected motor horsepower and full load amperes.
  - 6. Location of major distribution open junction boxes with 2" conduit and over.
  - 7. Location of all underground raceways or duct banks dimensioned from easily identified points with depth indicated from BFG (below finished grade) and by elevation in feet.

#### 1.11 GUARANTEE AND SERVICE:

- A. Upon completion of all tests and acceptance, the Contractor shall furnish the Owner a written guarantee covering the electrical work done for a period of one (1) year from date of acceptance. Guarantee includes equipment capacity and performance ratings specified without excessive noise levels. Upon notice from the Architect or the Owner, the Contractor shall, during the guarantee period, rectify and replace any defective material or workmanship and repair any damage caused thereby without additional cost.

## PART 2 - EXECUTION

### 2.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1-2015.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

END OF SECTION 26 05 00

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## **SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Copper building wire rated 600 V or less.
  2. Aluminum building wire rated 600 V or less.
  3. Fire-alarm wire and cable.
  4. Connectors, splices, and terminations rated 600 V and less.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.  
B. Product Schedule: Indicate type, use, location, and termination locations.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alpha Wire Company.
  2. General Cable Technologies Corporation.
  3. Okonite Company (The).
  4. Southwire Company.
- C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. RoHS compliant.
  3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.



- E. Conductor Insulation – All types may not be indicated below, coordinate with Drawings and intended uses:
  - 1. Type NM: Comply with UL 83 and UL 719.
  - 2. Type RHH and Type RHW-2: Comply with UL 44.
  - 3. Type USE-2 and Type SE: Comply with UL 854.
  - 4. Type THHN and Type THWN-2: Comply with UL 83.
  - 5. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
  - 6. Type XHHW-2: Comply with UL 44.

## 2.2 ALUMINUM BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Allowed Use Locations: Aluminum conductors may only be used on feeder or distribution circuits larger than 100A. The Drawings typically indicate all conductor sizes in copper. The contractor shall provide a cross reference table for engineer approval prior to any conductor to be substituted with an aluminum conductor.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alpha Wire Company.
  - 2. General Cable Technologies Corporation.
  - 3. Okonite Company (The).
  - 4. Southwire Company.
- D. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. RoHS compliant.
  - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- E. Conductors: Aluminum, complying with ASTM B800 and ASTM B801.
- F. Conductor Insulation – All types may not be indicated below, coordinate with Drawings and intended uses:
  - 1. Type NM: Comply with UL 83 and UL 719.
  - 2. Type RHH and Type RHW-2: Comply with UL 44.
  - 3. Type USE-2 and Type SE: Comply with UL 854.
  - 4. Type THHN and Type THWN-2: Comply with UL 83.
  - 5. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
  - 6. Type XHHW-2: Comply with UL 44.

## 2.3 FIRE-ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Cable Technologies Corporation.

2. Okonite Company (The).
3. Southwire Company.

- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 16 AWG.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
  1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
  2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

## 2.4 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 3 AWG; copper or aluminum for feeders No. 3 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Walls and Partitions: Type THHN/THWN-2, single conductors in raceway.
- E. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

- F. Feeders in Cable Tray: Type THHN/THWN-2, single conductors in raceway or Type RHW-2/USE-2 if exterior located.
- G. Exposed Branch Circuits, Including in Crawlspace: Type XHHW-2, single conductors in raceway.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according as required by other Specification sections."

### 3.4 INSTALLATION OF FIRE-ALARM WIRING

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- D. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

- E. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### 3.5 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.
- D. Prior to conduit/conductor routing to outlets, contractor shall request final verification of locations. Outlets shall be allowed to be moved 10 feet prior to installation with no cost change.
- E. Comply with requirements in accompanying Section on Fire Alarm Systems for connecting, terminating, and identifying wires and cables.

### 3.6 IDENTIFICATION

- A. Identify and color-code conductors and cables according to requirements in accompanying Sections in this book of Specifications.
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in accompanying Sections in this book of Specifications.

### 3.8 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to requirements in accompanying Sections in this book of Specifications.

END OF SECTION 26 05 19

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## **SECTION 26 05 23 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Balanced twisted pair cabling hardware.
  - 2. RS-485 cabling.
  - 3. Low-voltage control cabling.
  - 4. Control-circuit conductors.

#### 1.2 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 QUALITY ASSURANCE

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
  - 1. Flame Travel Distance: 60 inches or less.
  - 2. Peak Optical Smoke Density: 0.5 or less.
  - 3. Average Optical Smoke Density: 0.15 or less.
- C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.
- E. RoHS compliant.

## 2.2 BALANCED TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMP NETCONNECT; a TE Connectivity Ltd. company.
  2. Belden CDT Networking Division/NORDX.
  3. General Cable; General Cable Corporation.
  4. Hubbell Premise Wiring.
  5. Siemon Co. (The).
  6. Superior Essex Inc.
- C. General Requirements for Balanced Twisted Pair Cable Hardware:
1. Comply with the performance requirements of Category 5e and/or Category 6 as applicable to product used.
  2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
  3. Cables shall be terminated with connecting hardware of same category or higher.
- D. Connecting Blocks: 110-style IDC for Category 5e or Category 6 as applicable Provide blocks for the number of cables terminated on the block, plus 20 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- E. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
1. Features:
    - a. Universal T568A and T568B wiring labels.
    - b. Labeling areas adjacent to conductors.
    - c. Replaceable connectors.
    - d. 12, 24 or 48 ports.
  2. Construction: 16-gauge steel and mountable on 19-inch equipment racks or on wall-mountable independent of an equipment rack.
- F. Patch Cords: Factory-made, four-pair cables in lengths necessary to connect equipment or as indicated on the Drawings; terminated with an eight-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant and color coded boots to ensure performance. Patch cords shall have latch guards to protect against snagging.
- G. Plugs and Plug Assemblies:
1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
  2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.
  3. Marked to indicate transmission performance.
- H. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standards.
  - a. Category 5e, unshielded balanced twisted pair cable shall comply with IEC 60603-7-2.
  - b. Category 5e, shielded balanced twisted pair cable shall comply with IEC 60603-7-3.
  - c. Category 6, unshielded balanced twisted pair cable shall comply with IEC 60603-7-4.
  - d. Category 6, shielded balanced twisted pair cable shall comply with IEC 60603-7.5.
4. Marked to indicate transmission performance.

I. Faceplate:

1. Port quantity as indicated on the Drawings, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Plastic Faceplate: High-impact plastic. Coordinate color with Drawings and Architect
3. Metal Faceplate: Stainless steel, complying with requirements in "Wiring Devices."
4. For use with snap-in jacks accommodating any combination of balanced twisted pair, optical fiber, and coaxial work area cords.
  - a. Flush mounting jacks, positioning the cord at a 45-degree angle.

J. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

## 2.3 TWIN-AXIAL DATA HIGHWAY CABLE

A. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, One pair or as noted on Drawings, No. 18 AWG, stranded (7x32) tinned-copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

## 2.4 RS-232 CABLE

A. PVC-Jacketed, TIA 232-F:

1. Nine, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. PVC jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.



6. NFPA 70 Type: Type CM.
7. Flame Resistance: Comply with UL 1581.

B. Plenum-Type, TIA 232-F:

1. Nine, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PE insulation.
3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
4. Fluorinated ethylene propylene jacket.
5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.5 RS-485 CABLE

A. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262.

2.6 LOW-VOLTAGE CONTROL CABLE

A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. Multi-pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.7 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- B. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- D. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.
  1. Smoke control signaling and control circuits.

## 2.8 FIRE-ALARM WIRE AND CABLE

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
  - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
  - 1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
  - 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
  - 3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NRTL listed for fire-alarm and cable tray installation, plenum rated.

## 2.9 SOURCE QUALITY CONTROL

- A. Factory test balanced twisted pair cables according to TIA-568-C.2.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
  - 1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
  - 2. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.
- D. Raceway Installation in Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard if entering the room from overhead.
  - 4. Extend conduits 4 inches above finished floor.

5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

### 3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lay on removable ceiling tiles.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
15. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Install termination hardware as specified in "Communications Copper Horizontal Cabling" unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in "Raceways and Boxes for Electrical Systems."

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Below each feed point, neatly coil a minimum of 72 inches of cable in a coil not less than 18 inches in diameter.

### 3.3 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

### 3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

### 3.5 FIRESTOPPING

- A. Comply with TIA-569-D, Annex A, "Firestopping."  
B. Comply with BICSI TDMM, "Firestopping" Chapter.

### 3.6 GROUNDING

- A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.  
B. For low-voltage control wiring and cabling, comply with requirements "Grounding and Bonding for Electrical Systems."

### 3.7 IDENTIFICATION

- A. Comply with requirements for identification specified in "Identification for Electrical Systems."  
B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

- C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire shall have a unique tag.

### 3.8 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- B. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 05 23

## **SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

#### 1.2 ACTION SUBMITTALS

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

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

#### 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Burndy; Part of Hubbell Electrical Systems.
  - 2. ERICO; a brand of nVent.
  - 3. Galvan Industries, Inc.; Electrical Products Division, LLC.
  - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 5. Thomas & Betts Corporation; A Member of the ABB Group.

#### 2.3 CONDUCTORS

- B. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- C. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.
  4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- E. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- F. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- G. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- H. Straps: Solid copper, copper lugs. Rated for 600 A.
- I. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- J. Water Pipe Clamps:
  1. Mechanical type, two pieces with stainless-steel bolts.
    - a. Material: Die-cast zinc alloy.
    - b. Listed for direct burial.
  2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

## 2.5 GROUNDING ELECTRODES

- K. Ground Plates: 1/4 inch thick, hot-dip galvanized.

### PART 3 - EXECUTION

#### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.
- B. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

#### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

#### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.



3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

### 3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

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## **SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Conduit and cable support devices.
4. Support for conductors in vertical conduit.
5. Structural steel for fabricated supports and restraints.
6. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
7. Fabricated metal equipment support assemblies.

#### 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 the following:
  - a. Slotted support systems, hardware, and accessories.
  - b. Clamps.
  - c. Hangers.
  - d. Sockets.
  - e. Eye nuts.
  - f. Fasteners.
  - g. Anchors.
  - h. Saddles.
  - i. Brackets.
2. Include rated capacities and furnished specialties and accessories.

### PART 2 - PRODUCTS

#### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Manufacturers: Subject to compliance with requirements, undefined:
    - a. Allied Tube & Conduit; a part of Atkore International.
    - b. B-line, an Eaton business.
    - c. Thomas & Betts Corporation; A Member of the ABB Group.
    - d. Unistrut; Part of Atkore International.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Material for Channel, Fittings, and Accessories: Galvanized steel.
  4. Channel Width: Selected for applicable load criteria.
  5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c. in at least one surface.
1. Manufacturers: Subject to compliance with requirements, undefined:
    - a. Cooper Industries, Inc.
    - b. Thomas & Betts Corporation; A Member of the ABB Group.
    - c. Unistrut; Part of Atkore International.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Channel Material: 6063-T5 aluminum alloy.
  4. Fittings and Accessories Material: 5052-H32 aluminum alloy.
  5. Channel Width: Selected for applicable load criteria.
  6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, undefined:
      - 1) Hilti, Inc.
      - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - a. Manufacturers: Subject to compliance with requirements, undefined:
    - 1) B-line, an Eaton business.
    - 2) Hilti, Inc.
    - 3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
    - 4) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F 3125/F 3125M, Grade A325 .
6. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  - 1) NECA 1.
  - 2) NECA 101
  - 3) NECA 102.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.

- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC and RMC may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

- B. Use 3000 psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 26 05 29



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## **SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

#### 1.2 SUMMARY

##### A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.
5. Handholes and boxes for exterior underground cabling.

##### B. Related Requirements:

1. "Penetration Firestopping" for firestopping at conduit and box entrances.
2. "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

#### 1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allied Tube & Conduit; a part of Atkore International.
  - b. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - c. Southwire Company.
  - d. Thomas & Betts Corporation; A Member of the ABB Group.
  - e. Wheatland Tube Company.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - a. Comply with NEMA RN 1.
  - b. Coating Thickness: 0.040 inch, minimum.
6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Allied Tube & Conduit; a part of Atkore International.
  - b. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - c. Southwire Company.
  - d. Thomas & Betts Corporation; A Member of the ABB Group.
  - e. Wheatland Tube Company.
2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:
  - a. Material: Steel.
  - b. Type: Setscrew or compression.
7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
8. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS AND FITTINGS

### A. Nonmetallic Conduit:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. RACO; Hubbell.
  - b. Thomas & Betts Corporation; A Member of the ABB Group.
  - c. United Fiberglass.
- 2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 3. Fiberglass:
  - a. Comply with NEMA TC 14.
  - b. Comply with UL 2515 for aboveground raceways.
  - c. Comply with UL 2420 for belowground raceways.
- 4. ENT: Comply with NEMA TC 13 and UL 1653.
- 5. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- 6. LFNC: Comply with UL 1660.

### B. Nonmetallic Fittings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. RACO; Hubbell.
  - b. Thomas & Betts Corporation; A Member of the ABB Group.
  - c. United Fiberglass.
- 2. Fittings, General: Listed and labeled for type of conduit, location, and use.
- 3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
  - a. Fittings for LFNC: Comply with UL 514B.
- 4. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. B-line, an Eaton business.
  - 2. Hoffman; a brand of nVent.
  - 3. MonoSystems, Inc.

- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 Type 3R unless otherwise indicated, and sized according to NFPA 70.
  - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Crouse-Hinds, an Eaton business.
  - 2. EGS/Appleton Electric.
  - 3. Hoffman; a brand of nVent.
  - 4. Hubbell Incorporated.
  - 5. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 6. RACO; Hubbell.
  - 7. Thomas & Betts Corporation; A Member of the ABB Group.
  - 8. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- E. Nonmetallic Floor Boxes: Nonadjustable, rectangular or round, as indicated on Drawings.
  - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- J. Gangable boxes are allowed.

- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
  
- L. Cabinets:
  - 1. NEMA 250, Type 1 Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.
  - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
  - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
  - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armorcast Products Company.
    - b. Oldcastle Enclosure Solutions.
    - c. Quazite: Hubbell Power Systems, Inc.
  - 2. Standard: Comply with SCTE 77.
  - 3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
  - 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  - 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 6. Cover Legend: Molded lettering, "ELECTRIC."
  - 7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  - 8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC IMC.
2. Concealed Conduit, Aboveground: GRC IMC EMT RNC, Type EPC-40-PVC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried concrete encased.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: IMC. Raceway locations include the following:
  - a. Loading dock.
  - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
  - c. Mechanical rooms.
  - d. Gymnasiums.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Complete raceway installation before starting conductor installation.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches of enclosures to which attached.
- L. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
  - 5. Change from ENT to IMC before rising above floor.
- M. Stub-Ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.



- Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- R. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- S. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- T. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- U. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- V. Surface Raceways:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
  2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- W. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- X. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service raceway enters a building or structure.
  3. Conduit extending from interior to exterior of building.
  4. Conduit extending into pressurized duct and equipment.
  5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
  6. Where otherwise required by NFPA 70.
- Y. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- Z. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
  - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
  - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
  - d. Attics: 135 deg F temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- AA. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- BB. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- DD. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- EE. Locate boxes so that cover or plate will not span different building finishes.
- FF. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- GG. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- HH. Set metal floor boxes level and flush with finished floor surface.
- II. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.3 INSTALLATION OF UNDERGROUND CONDUIT
- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
  2. Install backfill as specified in Section 312000 "Earth Moving."

3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
  - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

#### 3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

#### 3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

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## **SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

#### 1.2 SUMMARY

##### A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

##### B. Related Requirements:

1. "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

#### 1.3 ACTION SUBMITTALS

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

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

##### A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
  - C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

#### 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Advance Products & Systems, Inc.
  - b. Metraflex Company (The).
  - c. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

### 2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
  1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Emerson
    - b. Innerlynx, Eaton Crouse-Hinds, a Cooper Industries Company
    - c. Link-Seal, GPT an EnPro Industries Company
    - d. Metraflex

### 2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

### 2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
  2. Sealant shall have a VOC content of 50 g/L or less.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

### PART 3 - EXECUTION

#### 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

#### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.



3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls.  
Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

## **SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Delegated-Design Submittal: For arc-flash hazard study.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 70.
- B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- C. Comply with ANSI Z535.4 for safety signs and labels.
- D. Comply with NFPA 70E and "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

## 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
1. Black letters on an white field.
  2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
- C. Color-Coding for Phase **and Voltage-Level** Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
  2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  3. Colors for 240-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
  4. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  5. Color for Neutral: White or Gray
  6. Color for Equipment Grounds: Bare copper, Green, or Green with a yellow stripe.
- D. Warning Label Colors:
1. Identify system voltage with black letters on an orange background.
- E. Warning labels and signs shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES ."
- F. Equipment Identification Labels:
1. White letters on a Black field.

## 2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

- B. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3.5-mil thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
  - 1. Minimum Nominal Size:
    - a. 1-1/2 by 6 inches for raceway and conductors.
    - b. 3-1/2 by 5 inches for equipment.
    - c. As required by authorities having jurisdiction.

## 2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameter and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

## 2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Tape and Stencil: 4-inch- wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.
- D. Floor Marking Tape: 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
- E. Underground-Line Warning Tape:
  - 1. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications lines.
    - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
  - 2. Color and Printing:
    - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"
    - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
  - 3. Description:
    - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the

continuity of the conductive core; bright colored, compounded for direct-burial service.

- b. Width: 3 inches.
- c. Overall Thickness: 5 mils.
- d. Foil Core Thickness: 0.35 mil.
- e. Weight: 28 lb/1000 sq. ft.
- f. Tensile according to ASTM D882: 70 lbf and 4600 psi.

- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.6 SIGNS

- A. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:
  - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
  - b. For signs larger than 20 sq. in., 1/8 inch thick.
  - c. Engraved legend with black letters on white face
  - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.

## 2.7 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

## 2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
- H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer and/or any emergency operations.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "EMERGENCY POWER"
  - 2. "POWER"

3. "LIFE SAFETY"

M. Vinyl Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

N. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

P. Self-Adhesive Labels:

1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

Q. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

R. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

S. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

T. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

U. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

V. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

W. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

X. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

- Y. Cable Ties: General purpose, for attaching tags, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.

### 3.2 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
  - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "EMERGENCY POWER"
  - 2. "POWER"
  - 3. "LIFE SAFETY"
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.
  - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags self-adhesive wraparound labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes with the conductor designation.
- H. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- I. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- J. Workspace Indication: Apply floor marking tape and stencil] to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and



29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

- K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
  - 1. Apply to exterior of door, cover, or other access.
  - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
    - b. Controls with external control power connections.
- M. Arc Flash Warning Labeling: Self-adhesive labels.
- N. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.
- O. Emergency Operating Instruction Signs: Laminated acrylic or melamine plastic signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer and other emergency operations.
- P. Equipment Identification Labels:
  - 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
  - 2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION 26 05 53

## **SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS**

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Related Documents:

1. Drawings and general provisions of the Subcontract apply to this Section.
2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

##### B. Section Includes:

1. This section specifies the unique responsibilities that are a part of, or are related to the commissioning process for the electrical systems. Electrical systems include those listed in Division 01 Section "General Commissioning Requirements" as being commissioned. All statements are the responsibility of the Subcontractor, unless specifically stated otherwise.
2. Electrical testing specified for systems not listed as formally commissioned are not under the commissioning umbrella and are not governed by this section.
3. Electrical Systems Commissioning consists of static checks of component and system installations and actual testing of equipment conditions and functions.
4. The Commissioning Authority will review and approve, prior to use, all test procedures and forms used and will witness a varying fraction of the initial checks and testing performed by the Subcontractor. The Commissioning Authority will review the completed check and test documentation of the Subcontractor of all checks and tests.
5. Electrical testing requirements are found in various sections in Division 01 and in Division 26 (Division 01 Section "General Commissioning Requirements" and this section). It is not the intent of the commissioning process or these specifications to duplicate efforts or to require the Subcontractor to perform any check or test twice. Checks and testing by the Subcontractor are expected to occur once in the normal sequence of installation and checkout, if appropriate coordination has occurred allowing the Commissioning Authority to witness installations and initial testing. Identical electrical checks and testing requirements in both Division 01 and Division 26 are referring to the same event.
6. The test requirements listed in this section do not release the Subcontractor from the obligation to perform all other appropriate, industry standard, manufacturer-recommended or code-required checks and tests.
7. Testing Participants. The work of this section shall be performed by parties identified in the Check and Testing Responsibility Table--a supplement to Division 01 Section "General Commissioning Requirements". Static checks and testing shall be fully documented according to provisions in Division 01 Section "General Commissioning Requirements".

##### C. Related Sections:

1. Division 01 Section "General Requirements."
2. Division 01 Section "Special Procedures."
3. Division 01 Section "General Commissioning Requirements".

#### 1.2 SUBMITTALS

- ##### A. Submit under provisions of Divisions 01 Section "General Requirements" and "Special Procedures."

### 1.3 QUALITY ASSURANCE

- A. Qualifications:
  - 1. The CTC (Certified Testing Company) performing the work of this section shall be qualified to test electrical equipment and is a NETA (National Electrical Testing Association)-certified testing agency. The CTC shall not be associated with the manufacturer of equipment or systems under test.
- B. Test Equipment:
  - 1. The Subcontractor shall provide all test equipment necessary to fulfill the checks and testing requirements. Test equipment shall have been calibrated within one (1) year of its use on the project.
  - 2. Refer to Division 01 Section "General Commissioning Requirements" for additional requirements.

## PART 2 - EXECUTION

### 2.1 SUBMITTALS

- A. Sixty (60) days before any testing is conducted, submit an overall testing plan and schedule for electrical systems that lists the equipment, modes to be tested, dates of testing and parties conducting the tests. Put these tests into the master construction schedule. Keep this plan and schedule updated.
- B. Additional submittal requirements relative to commissioning are found in this Section and in Division 01 Section "General Commissioning Requirements" and Division 01 Section "General Requirements."

### 2.2 COMMON RESPONSIBILITIES

- A. The following are responsibilities applicable to all electrical systems being commissioned.
- B. The general commissioning requirements and coordination are detailed in Division 01 Section "General Commissioning Requirements" and apply to electrical systems. The Subcontractor shall be familiar with all parts of Division 01 Section "General Commissioning Requirements" and the commissioning plan issued by the Commissioning Authority and shall execute all commissioning responsibilities assigned to them in the Contract Documents.
- C. The work of this Section shall be performed by a CTC (Certified Testing Company, Electrical), by the EC (Electrical Subcontractor), or the MSR (Manufacturer's Service Representative). The Commissioning Authority has some testing responsibilities for some equipment. The specified checks and static tests are conducted by any of the above listed parties, but the tests requiring measurements or special tools or skills are generally conducted only by the CTC. The Check and Testing Responsibility Table, included as a supplement to Division 01 Section "General Commissioning Requirements" provides specific allocation of checklist oversight and testing responsibilities. The CTC, EC, and MSR shall document all checks and testing on check and test procedure forms submitted to and approved by the Commissioning Authority prior to testing.
- D. The Subcontractor shall notify the CA ahead of time when commissioning activities not yet performed or not yet scheduled will delay construction. The Subcontractor shall be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.

- E. The Subcontractor shall respond to notices of issues identified during the commissioning process, making required corrections or clarifications and returning prompt notification to the Commissioning Authority according to the process given in Division 01 Section "General Commissioning Requirements".
- F. When completion of a task or other issue has been identified as holding up any commissioning process, particularly functional testing, the Subcontractor shall, within two (2) days of notification of the issue, notify the Commissioning Authority in writing providing an expected date of completion. The Subcontractor shall notify the Commissioning Authority in writing within one day of completion. It is not the responsibility of the Commissioning Authority to obtain this status information through meeting attendance, asking questions or field observation
- G. Construction Checklists. The Commissioning Authority or Subcontractor shall develop checklists as noted in the list of commissioned systems in Division 01 Section "General Commissioning Requirements", following the process described in Division 01 Section "General Commissioning Requirements" and in this Section. At a minimum, for a given piece of equipment, checks from the inspection checklists in NETA Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems shall be included in the electrical checklists. The Subcontractor shall execute and document all checks.
- H. Check and testing procedure and startup plan development and execution responsibilities are described in the Check and Testing Responsibility Table in the supplements to Division 01 Section "General Commissioning Requirements".
- I. The Subcontractor shall review design documents, shop drawings and O&M manuals and manufacturer recommended installation and testing procedures of each system installation.
- J. The Subcontractor shall monitor installation to ensure the equipment, configuration and quality of construction meets the design requirements, approved submittals and shop drawings.
- K. The Subcontractor shall develop test procedures and forms and execute and document testing according to the requirements of this Section, Division 01 Section "General Commissioning Requirements" and other specification sections containing testing requirements.
- L. Tests of energized equipment shall be conducted when the equipment is operating at its normal capacity. This may require some tests to be conducted after occupancy.
- M. Training and Orientation. The Subcontractor shall follow the facility staff orientation and training requirements as described in Division 01 Section "Demonstration and Training" and other applicable technical sections.
- N. Operation And Maintenance (O&M) Manuals. Refer to Division 01 Section "General Commissioning Requirements" and Division 01 Section "General Requirements" for requirements for O&M manuals.

### PART 3 - EQUIPMENT-SPECIFIC VERIFICATION AND TESTING REQUIREMENTS

#### 3.1 SUMMARY

- A. This Part specifies the check and testing requirements for electrical components and systems. From these requirements, the Commissioning Authority or Subcontractor will develop detailed procedures and forms. The general testing process, requirements and test method definitions are described in Division 01 Section "General Commissioning Requirements".

### 3.2 CHECKS AND TESTS

- A. Checks are intended to begin upon completion of a component or equipment installation. Testing generally occurs later when systems are energized or nearing that point. Beginning system testing before full completion, does not relieve the Subcontractor from fully completing the system as soon as possible, including all construction checklists and may require retesting portions of the system once all components are fully functioning.
- B. Refer to Division 01 Section "General Commissioning Requirements" for specific details on non-conformance issues relating to construction checklists and tests. Refer to Division 01 Section "General Commissioning Requirements", for common requirements of deferred testing and to articles in this Section.
- C. The check and test procedures and record forms shall contain the following:
  - 1. The Subcontractors executing the checks or tests.
  - 2. A list of the integral components being inspected and tested, equipment tag numbers, manufacturer, model number, pertinent performance information / rating data.
  - 3. Test equipment used.
  - 4. Construction checklists associated with the components, if any.
  - 5. Any special required conditions of the check or test for each procedure.
  - 6. Items, conditions or functions to be inspected, verified or tested, the checks and testing method given and a place provided with results recorded.
  - 7. Acceptance criteria (or reference by specific table where the acceptance criteria is found).
  - 8. For each procedure, list the technician performing check or test and company, witnesses of the tests and dates of tests.
  - 9. Sampling strategies used.
- D. The test procedures for dynamic equipment like lighting controls, emergency generator or fire alarm shall contain more step-by-step procedures with expected responses similar to the sample test provided as a supplement to Division 01 Section "General Commissioning Requirements". The test procedures and forms for more static components like panel boards, switch gear, circuit breakers, transformers, etc., can be more checklist-like in format. For each piece of equipment, checks and test procedures and their documentation record forms may be different documents or combined in the same document, but checks and tests should be grouped.
- E. At the Commissioning Authority's discretion, if large numbers or repeated deficiencies are encountered, the Subcontractor shall test and troubleshoot all remaining systems at issue on their own before commissioning with the Commissioning Authority will resume.
- F. Sampling for Identical Units. When there are a number of identical units, at the Commissioning Authority's discretion, some or all procedures of a test for a piece of equipment or assembly may be omitted when these same tests on other pieces of identical equipment or assemblies were conducted without deficiency.

### 3.3 EQUIPMENT-SPECIFIC TESTING REQUIREMENTS

- A. The following paragraphs define the testing requirements for each type of system or feature that is a part of the project. The Commissioning Authority shall use this information to develop specific testing procedures for each of the systems to be commissioned. The Subcontractor shall be responsible for support, execution and coordination of these tests as described in the project specifications including intersystem tests and interlocks with systems in Divisions other than Division 26.

B. Common Testing Requirements

1. The following requirements apply to all electrical systems and features that are to be commissioned when referenced below. Tests shall:
  - a. Verify functionality and compliance with the design intent for each individual sequence module in the sequences of operation. Verify proper operation of all control strategies, energy efficiency and self-diagnostics features by stepping through each sequence and documenting equipment and system performance. Test every step in every written sequence and other significant modes, sequences and operational features not mentioned in written sequences; including startup, normal operation, shutdown, scheduled on and off, unoccupied and manual modes, safeties, alarms, over-rides, lockouts and power failure.
  - b. Verify all alarm and high and low limit functions and messages generated on all points with alarm settings.
  - c. Verify integrated performance of all components and control system components, including all interlocks and interactions with other equipment and systems.
  - d. Verify time of day schedules and setpoints.
  - e. Verify all energy saving control strategies.
  - f. Verify operator control of all commandable control system points including proper security level access.
  - g. When testing procedures for commissioned equipment are listed in NETA Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems the NETA test procedures shall be part of the testing requirements of this specification. Additional testing procedures may be listed in this specification.
  - h. Common Acceptance Criteria
2. The following common acceptance criteria apply to all mechanical equipment, assemblies and features:
  - a. For the conditions, sequences and modes tested, the equipment, integral components and related equipment shall respond to varying loads and changing conditions and parameters appropriately as expected, according to the sequences of operation, as specified, according to acceptable operating practice and the manufacturer's performance specifications. Verify that equipment operates within tolerances specified in: governing codes, acceptance criteria contained in the construction documents, manufacturer's literature and according to good operating practice.
  - b. Systems shall accomplish their intended function and performance.
  - c. All safety trips shall require a manual reset to allow a system restart.
  - d. Resetting a manual safety shall result in a stable, safe, and predictable return to normal operation by the system.
  - e. Safety circuits and permissive control circuits shall function in all possible combinations of selector switch positions (hand, auto, inverter, bypass, etc.).
  - f. Other acceptance criteria is given in the equipment testing requirements articles or referenced standards.
  - g. Additional acceptance criteria will be developed by the Commissioning Authority when detailed test procedures are developed.
  - h. When testing procedures for commissioned equipment are listed in NETA Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems the NETA performance criteria shall apply.

C. Equipment-Specific Testing Requirements:

1. Scheduled Lighting Controls.
  - a. Apply the applicable common testing requirements and acceptance criteria.
  - b. Test Methods. Utilize active testing, and trending when available. If able to trend, trend all zones over a week period and follow the trending guidelines in Division 23 Section "Commissioning of HVAC".
  - c. Sampling Strategy. Manually test 20 percent of the zones or at least four. If more than 10 percent or two zones fail, test another 10 percent sample. If the second

- sample fails the Subcontractor shall document retesting on all zones on their own using a Commissioning Authority approved form.
2. Occupancy/Vacancy Sensor Lighting Controls.
    - a. Apply applicable common testing requirements and acceptance criteria. Test all units functions, including sensor sensitivity and time-to-OFF functions and ensure that sensor location is proper and won't be tripped inadvertently by other occupants and movements outdoors, etc.
  - D. Test Methods. Utilize active test methods.
    - a. Sampling Strategy. Test 10 percent of the sensors or six, whichever is greater. If more than 10 percent or two sensors fail, test another 10 percent sample. If the second sample fails the Subcontractor shall document retesting on all units on their own using a Commissioning Authority approved form.
    - b. Additional Acceptance Criteria. Reasonable sensitivity, no inadvertent trips, lights go off within 15 seconds of design.
  2. Fire Alarm.
    - a. Apply applicable common testing requirements and acceptance criteria.
    - b. Test the fire alarm system according to NFPA 110-1999 7-1 through 7-2, and specification Division 28 Section "Multiplex Addressable Fire Alarm System – Voice Evacuation".
    - c. Document all test procedures and results. A fire alarms system printout of the test annunciation record is not sufficient documentation.
    - d. Verify all fire alarm panel functions, alarms and troubles.
    - e. Verify all functions in the Fire Alarm Response Matrix, including remote communications.
    - f. Verify resetting of all equipment affected by an alarm.
    - g. Sampling Strategy. Verify device functions and annunciations per using the approved sampling rate of the authority having jurisdiction and per LBNL.

END OF SECTION 26 08 00

## **SECTION 26 09 43 - DISTRIBUTED INTELLIGENCE BASED LIGHTING CONTROL**

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Distributed Digital Lighting Control System: System includes
  1. Digital Lighting Controls
  2. Emergency Lighting Control.

#### 1.2 RELATED SECTIONS

- A. Section 26 51 19 – LED Interior Lighting.
- B. Section 26 52 13 - Emergency and Exit Lighting.

#### 1.3 REFERENCES

- A. NFPA 70 - National Electrical Code; National Fire Protection Association.
- B. NEMA - National Electrical Manufacturers Association
- C. FCC emission standards
- D. UL - Underwriters Laboratories, Inc. Listings
- E. UL 20 - General Use Switches, Plug Load Controls
- F. UL 924 - Standard for Emergency Lighting and Power Equipment

#### 1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
- B. System shall conform to requirements of NFPA 70.
- C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.
- D. System shall be listed under UL sections 916 and/or 508.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  1. Catalog sheets and specifications.
  2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
  3. Storage and handling requirements and recommendations.
  4. Installation instructions.
- C. Shop Drawings: Wiring diagrams for the various components of the System specified



including:

1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
  2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
  3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Closeout Submittals:
1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
  2. Operation and Maintenance Manual:
    - a. Include approved Shop Drawings and Product Data.
    - b. Include Sequence of Operation, identifying operation for each room or space.
    - c. Include manufacturer's maintenance information.
    - d. Operation and Maintenance Data: Include detailed information on device programming and setup.
    - e. Include startup and test reports.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

## 1.7 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.
- B. Review installation procedures and coordination required with related Work and the following:
1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
  2. Review the specifications for low voltage control wiring and termination.
  3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
- C. Inspect and make notes of job conditions prior to installation:
1. Record minutes of the conference and provide copies to all parties present.
  2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
  3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

## 1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under

environmental conditions outside manufacturer's absolute limits.

- B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
  2. Relative humidity: Maximum 90 percent, non-condensing.

#### 1.10 WARRANTY

- A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1) WattStopper, a division of Legrand North America, LLC.
  - 2) nLIGHT, a division of Acuity Brands Inc.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

#### 2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

- A. System General: Provide Digital Lighting Management System complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified, between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.
1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
  2. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.
- B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
1. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming output capabilities.
  2. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
  3. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches.

## 2.3 DIGITAL LOAD CONTROLLERS

- A. Digital Load Controllers: Digital controllers for lighting zones, fixtures automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features
1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
  2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
  3. Device Status LEDs to indicate:
    - a. Data transmission
    - b. Device has power
    - c. Status for each load
    - d. Configuration status
  4. Quick installation features including:
    - a. Standard junction box mounting
    - b. Quick low voltage connections using standard RJ-45 patch cable
  5. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
    - a. Turn on to 100 percent
    - b. Turn off
    - c. Turn on to last level
  6. Each load be configurable to operate in the following sequences based on occupancy:
    - a. Auto-on/Auto-off (Follow on and off)
    - b. Manual-on/Auto-off (Follow off only)
  7. UL 2043 plenum rated
  8. Manual override and LED indication for each load
  9. Zero cross circuitry for each load
  10. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
  11. Dimming Room Controllers shall share the following features:
    - a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
    - b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
    - c. Override button for each load provides the following functions:
      - 1) Press and release for on/off control
      - 2) Press and hold for dimming control
    - d. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
    - e. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
    - f. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.

- g. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
- B. On/Off Room Controllers shall include:
  - 1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
  - 2. One or two relay configuration
  - 3. Simple 150 mA switching power supply.
  - 4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
- C. On/Off/0-10V Dimming KO Mount Room Controllers shall include:
  - 1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A (or greater) total load
  - 2. One or two relays configurations
  - 3. Smart 150 mA switching power supply
  - 4. Two RJ-45 DLM local network ports. Provide molded strain relief ring
  - 5. One dimming output per relay
    - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting.

## 2.4 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
  - 1. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
  - 2. Load/Scene Status LED on each switch button with the following characteristics:
    - a. Bi-level LED
    - b. Dim locator level indicates power to switch
    - c. Bright status level indicates that load or scene is active
    - d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
  - 3. Programmable control functionality including:
    - a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
    - b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
  - 4. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- B. Two RJ-45 ports for connection to DLM local network.
- C. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
  - 1. Individual button function may be configured to Toggle, On only or Off only.
  - 2. Individual scenes may be locked to prevent unauthorized change.
  - 3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
  - 4. Ramp rate may be adjusted for each dimmer switch.
  - 5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Do not begin installation until measurements have been verified and work areas have been properly prepared.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

#### 3.2 INSTALLATION

- A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
- B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
  - 1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested prior to proceeding with the Work.
  - 2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.
  - 3. Low voltage wiring topology must comply with manufacturer's specifications.
- C. All line voltage connections shall be tagged to indicate circuit and switched legs.
- D. Test all devices to ensure proper communication.
- E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
- F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
  - 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  - 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
  - 3. Load Parameters (e.g. blink warning, etc.)
- G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.
- H. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.
- I. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.
- J. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

#### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect

components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

- B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
  - 1. Verify Class I and II wiring connections are terminated properly by validating system performance.
  - 2. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
  - 3. Verify that the control of each space complies with the Sequence of Operation.
  - 4. Correct any system issues and retest.
  
- C. Provide a report in table format with drawings or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
  - 1. Date of test or inspection.
  - 2. Loads per space, or Fixture Address identification.
  - 3. Quantity and Type of each device installed
  - 4. Reports providing each device's settings.

### 3.4 DEMONSTRATION AND TRAINING

- A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
  - 1. Confirmation of entire system operation and communication to each device.
  - 2. Confirmation of operation of individual relays, switches, and sensors.
  - 3. Confirmation of system Programming, photocell settings, override settings, etc.
  - 4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

### 3.5 PRODUCT SUPPORT AND SERVICE

- A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

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## **SECTION 26 22 13 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions in other Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

#### **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 each type and size of transformer.
  - 2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
- B. Shop Drawings:
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
  - 3. Include diagrams for power, signal, and control wiring.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing agency.
- B. Source quality-control reports.
- C. Field quality-control reports.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.



## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.
  - 1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.
- B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.
- C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
- D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D, a division of Schneider Electric
  - 2. G.E., a division of ABB
  - 3. Siemens Energy & Automation, Inc.
  - 4. Eaton Corporation, Cutler-Hammer Products
- B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

### 2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Comply with NFPA 70.
  - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
  - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
  - 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.
- D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

## 2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70, and list and label as complying with UL 1561.
- B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
  - 1. One leg per phase.
  - 2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
  - 3. Grounded to enclosure.
- C. Coils: Continuous windings without splices except for taps.
  - 1. Coil Material: Copper.
  - 2. Internal Coil Connections: Brazed or pressure type.
  - 3. Terminal Connections: Welded.
- D. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.
- E. Indoor Enclosure: Ventilated.
  - 1. NEMA 250, Type 1: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
  - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
  - 3. Wiring Compartment: Sized for conduit entry and wiring installation.
  - 4. Finish: Comply with NEMA 250.
    - a. Finish Color: ANSI 49 or ANSI 61 gray weather-resistant enamel.
- F. Outdoor Enclosure: Ventilated with hood.
  - 1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
  - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
  - 3. Wiring Compartment: Sized for conduit entry and wiring installation.
- G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- H. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- J. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.
- K. Wall Brackets: Manufacturer's standard brackets.

## 2.4 IDENTIFICATION

- A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

## 2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.
  - 1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
  - 2. Ratio tests at rated voltage connections and at all tap connections.
  - 3. Phase relation and polarity tests at rated voltage connections.
  - 4. No load losses, and excitation current and rated voltage at rated voltage connections.
  - 5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
  - 6. Applied and induced tensile tests.
  - 7. Regulation and efficiency at rated load and voltage.
  - 8. Insulation-Resistance Tests:
    - a. High-voltage to ground.
    - b. Low-voltage to ground.
    - c. High-voltage to low-voltage.
  - 9. Temperature tests.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
  - 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
- B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- C. Construct concrete bases according to "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in "Hangers and Supports for Electrical Systems."
  - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- D. Secure transformer to concrete base according to manufacturer's written instructions.
- E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- F. Remove shipping bolts, blocking, and wedges.

### 3.3 CONNECTIONS

- A. Ground equipment according to "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to "Low-Voltage Electrical Power Conductors and Cables."
- 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-486B.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

### 3.4 FIELD QUALITY CONTROL

- A. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
  - 1. Visual and Mechanical Inspection.
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, and grounding.
    - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
    - d. Verify the unit is clean.
    - e. Perform specific inspections and mechanical tests recommended by manufacturer.
    - f. Verify that as-left tap connections are as specified.

- g. Verify the presence of surge arresters and that their ratings are as specified.
2. Electrical Tests:
- a. Measure resistance at each winding, tap, and bolted connection.
  - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
  - c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
  - d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- B. Large (Larger Than 167-kVA Single Phase or 500-kVA Three Phase) Dry-Type Transformer Field Tests:
1. Visual and Mechanical Inspection:
- a. Inspect physical and mechanical condition.
  - b. Inspect anchorage, alignment, and grounding.
  - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
  - d. Verify the unit is clean.
  - e. Perform specific inspections and mechanical tests recommended by manufacturer.
  - f. Verify that as-left tap connections are as specified.
  - g. Verify the presence of surge arresters and that their ratings are as specified.
2. Electrical Tests:
- a. Measure resistance at each winding, tap, and bolted connection.
  - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
  - c. Perform power-factor or dissipation-factor tests on all windings.
  - d. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
  - e. Perform an excitation-current test on each phase.
  - f. Perform an applied voltage test on all high- and low-voltage windings to ground. See IEEE C57.12.91, Sections 10.2 and 10.9.
  - g. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- C. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.

2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
  3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

### 3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

### 3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 13

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## **SECTION 26 24 16 - PANELBOARDS**

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

#### 1.2 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.  
B. SPD: Surge protective device.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.  
B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Include evidence of NRTL listing for SPD as installed in panelboard.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include wiring diagrams for power, signal, and control wiring.
9. Key interlock scheme drawing and sequence of operations.
10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Panelboard schedules for installation in panelboards.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.



1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.
- D. Enclosures: Flush and/or Surface-mounted, as indicated on Drawings, dead-front cabinets.
1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    - b. Outdoor Locations: NEMA 250, Type 3R.
    - c. Wet or Damp Indoor Locations: NEMA 250, Type 4.
    - d. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
  2. Height: 84 inches (2.13 m) maximum.
  3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
- E. Phase, Neutral, and Ground Buses: Tin-plated aluminum.
- F. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Silver-plated hard-drawn copper, 98 percent conductivity.
  2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
  3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
- G. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices.
- H. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1 or Type 2.

## 2.3 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D, a division of Schneider Electric
  - 2. G.E., a division of ABB
  - 3. Siemens Energy & Automation, Inc.
  - 4. Eaton Corporation, Cutler-Hammer Products
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
  - 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

## 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D, a division of Schneider Electric
  - 2. G.E., a division of ABB
  - 3. Siemens Energy & Automation, Inc.
  - 4. Eaton Corporation, Cutler-Hammer Products
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D, a division of Schneider Electric
  - 2. G.E., a division of ABB
  - 3. Siemens Energy & Automation, Inc.
  - 4. Eaton Corporation, Cutler-Hammer Products

- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers:
    - a. Inverse time-current element for low-level overloads.
    - b. Instantaneous magnetic trip element for short circuits.
    - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 200 A and larger.
  2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  3. Electronic Trip Circuit Breakers:
    - a. RMS sensing.
    - b. Field-replaceable rating plug or electronic trip.
    - c. Digital display of settings, trip targets, and indicated metering displays.
    - d. Multi-button keypad to access programmable functions and monitored data.
    - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
    - f. Integral test jack for connection to portable test set or laptop computer.
    - g. Field-Adjustable Settings:
      - 1) Instantaneous trip.
      - 2) Long- and short-time pickup levels.
      - 3) Long and short time adjustments.
      - 4) Ground-fault pickup level, time delay, and I squared T response.
  4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  7. Subfeed Circuit Breakers: Vertically mounted.
  8. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Breaker handle indicates tripped status.
    - c. UL listed for reverse connection without restrictive line or load ratings.
    - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

## 2.6 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

- C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to NECA 407.
- C. Mount panels at height above finished floor so that no operating handle of switch or circuit breaker in the on position is higher than 79 inches (2000 mm).
- D. Mount panelboard cabinet plumb and rigid without distortion of box.
- E. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
- G. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- H. Install filler plates in unused spaces.
- I. Stub four 1-inch (27-EMT) empty conduits from panelboard into accessible ceiling space if so constructed or space designated to be ceiling space in the future. Stub four 1-inch (27-EMT) empty conduits into raised floor space or below slab not on grade.
- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

#### 3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in "Identification for Electrical Systems" identifying source of remote circuit.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 24 16

## **SECTION 26 27 26 - WIRING DEVICES**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Standard-grade receptacles, 125 V, 20 A.
  - 2. GFCI receptacles, 125 V, 20 A.
  - 3. SPD receptacles, 125 V, 20 A.
  - 4. Twist-locking receptacles.
  - 5. Toggle switches, 120/277 V, 20 A.
  - 6. Wall plates.

#### 1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. EMI: Electromagnetic interference.
- C. GFCI: Ground-fault circuit interrupter.
- D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- E. RFI: Radio-frequency interference.
- F. SPD: Surge protective device.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
  - 2. SPD Receptacles: One for every 10 of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
- B. Wiring Devices:
  - 1. Bryant Electric, Inc., Hubbell Subsidiary.
  - 2. Eagle Electric Manufacturing Co.
  - 3. Hubbell Incorporated; Wiring Device-Kellems.
  - 4. Leviton Mfg Company
  - 5. Pass & Seymour/Legrand; Wiring Devices Div.

2.2 GENERAL WIRING DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with requirements in this Section.
- F. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.
- G. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. SPD Devices: Blue.

H. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## 2.3 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

### A. Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

### B. Weather-Resistant Duplex Receptacle, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498."
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

## 2.4 GFCI RECEPTACLES, 125 V, 20 A

### A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

## 2.5 SPD RECEPTACLES, 125 V, 20 A

### A. Duplex SPD Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral SPD in line to ground, line to neutral, and neutral to ground. LED indicator light.
2. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
3. Active SPD Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
4. Configuration: NEMA WD 6, Configuration 5-20R.
5. Standards: Comply with NEMA WD 1, UL 498, UL 1449, and FS W-C-596.

## 2.6 TWIST-LOCKING RECEPTACLES

### A. Twist-Lock, Single Receptacles, 250 V, 20 A:



1. Configuration: NEMA WD 6, Configuration L6-20R.
2. Standards: Comply with UL 498.

2.7 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A:

1. Standards: Comply with UL 20 and FS W-S-896.

2.8 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum in use type with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.

4. Existing Conductors:
  - a. Cut back and pigtail, or replace all damaged conductors.
  - b. Straighten conductors that remain and remove corrosion and foreign matter.
  - c. Pigtail existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

B. Wiring device will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 26 27 26

## **SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Molded-case circuit breakers (MCCBs).
  - 4. Enclosures.

#### 1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and SKM electronic format.
- B. Shop Drawings: For enclosed switches and circuit breakers.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include wiring diagrams for power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Field quality-control reports.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
  - 1. Include the following:
    - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
    - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF and SKM format electronic format.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.
  - 2. Fuse Pullers: One for each size and type.

## 1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
  - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
  - 2. Altitude: Not exceeding 6600 feet (2010 m).

## 1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with NFPA 70.

## 2.2 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D, a division of Schneider Electric
  - 2. G.E., a division of ABB
  - 3. Siemens Energy & Automation, Inc.
  - 4. Eaton Corporation, Cutler-Hammer Products

## 2.3 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty:
  - 1. Single throw.
  - 2. Three pole.
  - 3. 600-V ac.
  - 4. Lockable handle with capability to accept three padlocks and interlocked with cover in closed position.
- B. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 4. Hookstick Handle: Allows use of a hookstick to operate the handle.
  - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.4 NONFUSIBLE SWITCHES

- A. Type GD, General Duty, Three Pole, Single Throw, 240-V ac, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- B. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 4. Hookstick Handle: Allows use of a hookstick to operate the handle.
  - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.5 MOLDED-CASE CIRCUIT BREAKERS

- A. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- B. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- C. MCCBs shall be equipped with a device for locking in the isolated position.
- D. Lugs shall be suitable for 194 deg F (90 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.
- E. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- F. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- G. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- H. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and I-squared t response.
- I. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- J. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- K. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- L. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
  - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

## 2.6 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1), gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, a brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1), directly operable through the dead front trim of the enclosure (NEMA 250 Type 3R) . The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

### 3.2 PREPARATION

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. See SECTION 260500 "ELECTRICAL GENERAL REQUIREMENTS" for direction on scheduled interruptions.
  - 2. Indicate method of providing temporary electric service.
  - 3. Comply with NFPA 70E.

### 3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.



1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen or Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

### 3.4 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.

### 3.5 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
  1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Switches:
  1. Visual and Mechanical Inspection:
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, grounding, and clearances.
    - c. Verify that the unit is clean.
    - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    - e. Verify that fuse sizes and types match the Specifications and Drawings.
    - f. Verify that each fuse has adequate mechanical support and contact integrity.
    - g. Inspect bolted electrical connections for high resistance using the following method:
      - 1) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
        - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

- h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
        - i. Verify correct phase barrier installation.
        - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
  - 2. Electrical Tests:
    - a. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."
- C. Tests and Inspections for Molded Case Circuit Breakers:
- 1. Visual and Mechanical Inspection:
    - a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment, grounding, and clearances.
    - d. Verify that the unit is clean.
    - e. Operate the circuit breaker to ensure smooth operation.
    - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
        - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
    - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
  - 2. Electrical Tests:
    - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
    - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
    - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
    - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
    - e. Determine the following by primary current injection:

- 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
  - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
  - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
  - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
1. Test procedures used.
  2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
  3. List deficiencies detected, remedial action taken, and observations after remedial action.

### 3.7 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION 26 28 16

## **SECTION 26 51 19 - LED INTERIOR LIGHTING**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes the following types of LED luminaires:
  - 1. Downlight.
  - 2. Linear industrial.
  - 3. Recessed, linear.
  - 4. Surface mount, linear.
  - 5. Surface mount, nonlinear.
- B. Related Requirements:
  - 1. Section 260943 "Distributed Intelligence Based Lighting Controls" for automatic control of lighting.

#### 1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.
  - 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
  2. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

#### 1.7 QUALITY ASSURANCE

- A. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- B. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.
  1. Obtain Architect's approval of luminaires in mockups before starting installations.
  2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  4. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

## 1.9 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Two year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Ambient Temperature: 41 to 104 deg F (5 to 40 deg C).
- B. Altitude: Sea level to 1000 feet (300 m).

### 2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Factory-Applied Labels: Comply with UL 1598. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp module characteristics:
    - a. Manufacturer
    - b. Model number
    - c. CCT and CRI.
- C. Recessed luminaires shall comply with NEMA LE 4.
- D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- F. Luminaire CRI requirements: Greater than 80 CRI unless noted otherwise on Drawings.
- G. Luminaire CCT requirements: 4000K unless noted otherwise on Drawings.
- H. Luminaire Lumen outputs: As indicated on Drawings or comparable with luminaire model specified on Drawings.
- I. Luminaire Rated Lamp Life: As comparable with luminaire model specified on Drawings.

## 2.3 DOWNLIGHT

- A. Nominal Operating Voltage: 120 V ac or 277 V ac, or as indicated on Drawings.
  - 1. Dimmable from 100 percent to 10 percent of maximum light output.
  - 2. Internal driver.
- B. Housings:
  - 1. Forged-aluminum housing and heat sink.
  - 2. Clear anodized finish.
  - 3. Universal mounting bracket.
  - 4. Integral junction box with conduit fittings.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- D. Standards:
  - 1. ENERGY STAR certified.
  - 2. RoHS compliant.
  - 3. Recessed luminaires shall comply with NEMA LE 4.

## 2.4 LINEAR INDUSTRIAL

- A. Nominal Operating Voltage: 120 V ac or 277 V ac, or as indicated on Drawings.
  - 1. Dimmable from 100 percent to 10 percent of maximum light output.
  - 2. Internal driver.
  - 3. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.
- B. Housings:
  - 1. Polycarbonate housing and heat sink.
  - 2. Painted finish.
  - 3. With integral mounting provisions.
  - 4. IP 66.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- D. Standards:
  - 1. ENERGY STAR certified.
  - 2. RoHS compliant.

## 2.5 RECESSED, LINEAR

- A. Nominal Operating Voltage: 120 V ac or 277 V ac, or as indicated on Drawings.
  - 1. Dimmable from 100 percent to 10 percent of maximum light output.
  - 2. Internal driver.
  - 3. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.
- B. Housings:
  - 1. Polycarbonate housing and heat sink.
  - 2. With integral mounting provisions.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- D. Standards:
  - 1. ENERGY STAR certified.
  - 2. RoHS compliant.
  - 3. UL Listing: Listed for damp location.
  - 4. NEMA LE 4.

## 2.6 SURFACE MOUNT, LINEAR

- A. Nominal Operating Voltage: 120 V ac or 277 V ac, or as indicated on Drawings.
  - 1. Dimmable from 100 percent to 10 percent of maximum light output.
  - 2. Internal driver.
  - 3. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.
- B. Housings:
  - 1. Polycarbonate housing and heat sink.
  - 2. Painted finish finish.
  - 3. With integral mounting provisions.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- D. Standards:
  - 1. ENERGY STAR certified.
  - 2. RoHS compliant.

## 2.7 SURFACE MOUNT, NONLINEAR

- A. Nominal Operating Voltage: 120 V ac or 277 V ac, or as indicated on Drawings.



1. Dimmable from 100 percent to 10 percent of maximum light output.
2. Internal driver.
3. Lens Thickness: At least 0.125-inch (3.175-mm) minimum unless otherwise indicated.

B. Housings:

1. Polycarbonate housing and heat sink.
2. Painted finish.
3. With integral mounting provisions.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

D. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.

## 2.8 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:

1. 1. Manufacturer's standard grade.
2. 2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

## 2.9 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.10 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: Minimum 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## 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 luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- D. Flush-Mounted Luminaires:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- E. Wall-Mounted Luminaires:
  - 1. Attached to structural members in walls.

2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaires:

1. Pendants, Aircraft Cable and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

- H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

### 3.5 ADJUSTING

- A. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

END OF SECTION 26 51 19

## SECTION 26 52 13 - EMERGENCY AND EXIT LIGHTING

### 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. Emergency lighting units.
  - 2. Exit signs.
  - 3. Luminaire supports.

#### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
  - 1. Include data on features, accessories, and finishes.
  - 2. Include physical description of the unit and dimensions.
  - 3. Battery and charger for light units.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.

- C. Product Schedule:
  - 1. For emergency lighting units.
  - 2. For exit signs.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Luminaire-mounted, emergency battery pack: One for every 50 emergency lighting units. Furnish at least one of each type.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### 1.8 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
  - 2. Warranty Period for Self-Powered Exit Sign Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.
  - 1. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - 2. Battery: Sealed, maintenance-free, nickel-cadmium type.
  - 3. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
  - 4. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

## 2.2 EMERGENCY LIGHTING

### A. Emergency Luminaires:

- 1. Emergency Luminaires: Interior Luminaire Schedule and Drawings.
  - a. Operating at nominal voltage of 120 V ac or 277 V ac
  - b. AC-Only connected to generator.
  - c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.
  - d. UL 94 flame rating.

## 2.3 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Operating at nominal voltage of 120 V ac or 277 V ac
  - 2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
  - 3. Self-Powered Exit Signs (Battery Type): AC-Only connected to generator.

## 2.4 MATERIALS

### A. Metal Parts:

- 1. Free of burrs and sharp corners and edges.
- 2. Sheet metal components shall be steel unless otherwise indicated.
- 3. Form and support to prevent warping and sagging.

### B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Housings:

1. Thermoplastic housing.
2. Painted finish.

D. Conduit: Electrical metallic tubing, minimum 3/4 inch (21 mm) in diameter.

## 2.5 METAL FINISHES

- A. 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.

## 2.6 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Support Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

### 3.5 STARTUP SERVICE

- A. Perform startup service:
  - 1. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.

### 3.6 ADJUSTING

- A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:
  - 1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.
    - a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 26 52 13



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## **SECTION 26 56 19 – LED EXTERIOR LIGHTING**

### 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. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
- 2. Luminaire supports.

- B. Related Requirements:

- 1. Section 260943 "Distributed Intelligence Based Lighting Controls" for automatic control of lighting.

#### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.4 ACTION SUBMITTALS

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

- 1. Arrange in order of luminaire designation.
- 2. Include data on features, accessories, and finishes.
- 3. Include physical description and dimensions of luminaire.
- 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

5. Wiring diagrams for power, control, and signal wiring.
6. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires to include operation and maintenance manuals.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Diffusers and Lenses: One for every 50 of each type and rating installed.
  2. Globes and Guards: One for every 50 of each type and rating installed.

#### 1.8 QUALITY ASSURANCE

- A. Provide luminaires from a single manufacturer for each luminaire type.
- B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- C. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

#### 1.10 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

#### 1.11 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Structural failures, including luminaire support components.
  - b. Faulty operation of luminaires and accessories.
  - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: (1) One year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. UL Compliance: Comply with UL 1598 and U.L. Listed for wet location if indicated.
- D. CRI: Minimum of 70 CRI
- E. CCT: 3000 K unless noted otherwise or is specific to wildlife lighting requirements.
- F. L70 lamp life of 50,000 hours.
- G. Internal driver.
- H. Nominal Operating Voltage: 277 V ac.
- I. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

### 2.2 LUMINAIRE TYPES

- A. Area and Site:
  1. Mounting: Pole or Building mounting as indicated.
  2. Distribution: Type II, Type III, Type IV, or Type V as indicated.
  3. Housings:
    - a. Cast-aluminum housing and heat sink.
    - b. Powder-coat painted finish.

### 2.3 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.

- B. Sheet Metal Components: Corrosion-resistant aluminum or Stainless steel. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- D. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- E. Housings:
  - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
  - 2. Provide filter/breather for enclosed luminaires.
- F. Factory-Applied Labels: Comply with UL 1598. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles where located in place.
  - 1. Label shall include the following characteristics:
    - a. CCT and CRI for all luminaires.

## 2.4 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
  - 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
  - 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
    - a. Color: As selected from manufacturer's standard catalog of colors.

## 2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

## 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 luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Fasten luminaire to structural support.
- C. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Support luminaires without causing deflection of finished surface.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- D. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls.
- E. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- F. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at heights as indicated on Drawings.
- G. Coordinate layout and installation of luminaires with other construction.
- H. Adjust luminaires that require field adjustment or aiming.
- I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

### 3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

- A. Install on concrete base with top 6 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth.

### 3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

### 3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.6 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- B. Luminaire will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 56 19

## **SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS**

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Digital alarm communicator transmitter.

B. Related Requirements:

1. Section "Control Voltage Electric Power Cables" for cables and conductors for fire-alarm systems.

#### 1.2 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.
- E. PC: Personal computer.
- F. VESDA: Very Early Smoke-Detection Apparatus.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor



- sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
  5. Include voltage drop calculations for notification-appliance circuits.
  6. Include battery-size calculations.
  7. Include input/output matrix.
  8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
  9. Include performance parameters and installation details for each detector.
  10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
  12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
    - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    - b. Show field wiring required for HVAC unit shutdown on alarm.
    - c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
    - d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
    - e. Locate detectors according to manufacturer's written recommendations.
  13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
  14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III Level IV technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

#### 1.5 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it

is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- B. Automatic sensitivity control of certain smoke detectors.
- C. All components provided shall be listed for use with the selected system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Smoke detectors.
  - 4. Duct smoke detectors.
  - 5. Carbon monoxide detectors.
  - 6. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
  - 1. Continuously operate alarm notification appliances.
  - 2. Identify alarm and specific initiating device at fire-alarm control unit.
  - 3. Transmit an alarm signal to the remote alarm receiving station.
  - 4. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
  - 5. Close smoke dampers in air ducts of designated air-conditioning duct systems.
  - 6. Unlock secured path of egress doors.
  - 7. Release smoke door hold open devices.
  - 8. Record events in the system memory.
  - 9. Indicate device in alarm on the graphic annunciator.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
  - 1. Valve supervisory switch.
  - 2. User disabling of zones or individual devices.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
  - 1. Open circuits, shorts, and grounds in designated circuits.

2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit.
3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
4. Display system status on graphic annunciator.

2.3 PERFORMANCE REQUIREMENTS

2.4 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, undefined:

1. Siemens Industry, Inc.; Fire Safety Division model XLS-MLE6-ADPT compatible with existing facility system.
2. No alternates such as to be compatible with existing facility fire alarm system.

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
  - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
  - b. Include a real-time clock for time annotation of events on the event recorder and printer.
  - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
  - d. The FACP shall be listed for connection to a central-station signaling system service.
  - e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.
  2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Pathway Class Designations: NFPA 72, Class B.
  2. Pathway Survivability: Level 0.
  3. Install no more than 50 addressable devices on each signaling-line circuit.
  4. Serial Interfaces:
    - a. One dedicated RS 485 port for remote station operation using point ID DACT.
    - b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    - c. One USB port for PC configuration.
    - d. One RS 232 port for VESDA HLI connection.
    - e. One RS 232 port for voice evacuation interface.
- E. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.
1. Pressurization starts when any alarm is received at fire-alarm control unit.
  2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.
- F. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
  2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
  3. Record events by the system printer.
  4. Sound general alarm if the alarm is verified.
  5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- G. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
  2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
  3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- H. Elevator Recall:
1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

- a. Elevator lobby detectors except the lobby detector on the designated floor.
  - b. Smoke detector in elevator machine room.
  - c. Smoke detectors in elevator hoistway.
2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
  - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- I. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.
- J. Secure Egress Door Controls: Provide an output signal using an addressable relay to unlock secured path of egress door devices upon system notification.
- K. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- L. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals shall be powered by 24-V dc source.
  1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- M. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
  1. Batteries: Sealed lead calcium.
- N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## 2.5 MANUAL FIRE-ALARM BOXES

- A. Manufacturers: Subject to compliance with requirements, undefined:
  1. Compatible with existing system Siemens Industry, Inc.; Fire Safety Division.
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
  1. Single-action mechanism, breaking-glass or plastic-rod type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod type; with addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Station Reset: Key- or wrench-operated switch.
4. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

## 2.6 SYSTEM SMOKE DETECTORS

### A. Manufacturers: Subject to compliance with requirements, undefined:

1. Compatible with existing system Siemens Industry, Inc.; Fire Safety Division.

### B. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
  - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
  - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
  - c. Multiple levels of detection sensitivity for each sensor.
  - d. Sensitivity levels based on time of day.

### C. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

### D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

## 2.7 HEAT DETECTORS

- A. Manufacturers: Subject to compliance with requirements, undefined:
  1. Compatible with existing system Siemens Industry, Inc.; Fire Safety Division.
- B. General Requirements for Heat Detectors: Comply with UL 521.
  1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
  1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

## 2.8 NOTIFICATION APPLIANCES

- A. Manufacturers: Subject to compliance with requirements, undefined:
  1. Compatible with existing system Siemens Industry, Inc.; Fire Safety Division.
- B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
- C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
  1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- E. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
  - 1. Rated Light Output:
    - a. 75 110 cd.
    - b. 75/110 cd, selectable in the field.
  - 2. Mounting: Wall mounted unless otherwise indicated.
  - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  - 4. Flashing shall be in a temporal pattern, synchronized with other units.
  - 5. Strobe Leads: Factory connected to screw terminals.
  - 6. Mounting Faceplate: Factory finished, red.

## 2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
  - 1. Verification that both telephone lines are available.
  - 2. Programming device.
  - 3. LED display.
  - 4. Manual test report function and manual transmission clear indication.
  - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
  - 1. Address of the alarm-initiating device.
  - 2. Address of the supervisory signal.
  - 3. Address of the trouble-initiating device.
  - 4. Loss of ac supply.
  - 5. Loss of power.
  - 6. Low battery.
  - 7. Abnormal test signal.
  - 8. Communication bus failure.



- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
  - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- C. Manual Fire-Alarm Boxes:
  - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
  - 2. Mount manual fire-alarm box on a background of a contrasting color.
  - 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- D. Smoke- or Heat-Detector Spacing:
  - 1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
  - 2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
  - 3. Smooth ceiling spacing shall not exceed 30 feet.

4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A in NFPA 72.
  5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
  6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.
1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- G. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- H. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- I. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- J. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- K. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- L. Device Location-Indicating Lights: Locate in public space near the device they monitor.

### 3.3 PATHWAYS

- A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.
1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.
- B. Pathways shall be installed in EMT.
- C. Exposed EMT shall be painted red enamel.

### 3.4 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
  - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
  - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
  - 3. Smoke dampers in air ducts of designated HVAC duct systems.
  - 4. Magnetically held-open doors.
  - 5. Electronically locked doors and access gates.
  - 6. Alarm-initiating connection to elevator recall system and components.
  - 7. Alarm-initiating connection to activate emergency lighting control.
  - 8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
  - 9. Supervisory connections at valve supervisory switches.
  - 10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
  - 11. Supervisory connections at elevator shunt-trip breaker.
  - 12. Data communication circuits for connection to building management system.
  - 13. Data communication circuits for connection to mass notification system.
  - 14. Supervisory connections at fire-extinguisher locations.
  - 15. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
  - 16. Supervisory connections at fire-pump engine control panel.

### 3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

### 3.6 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

### 3.7 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.

- a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
  5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
  6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

### 3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 46 21.11

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## SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Grounding conductors.
  2. Grounding connectors.
  3. Grounding busbars.
  4. Grounding rods.
  5. Grounding labeling.

#### 1.2 DEFINITIONS

- A. BCT: Bonding conductor for telecommunications.
- B. EMT: Electrical metallic tubing.
- C. TGB: Telecommunications grounding busbar.
- D. TMGB: Telecommunications main grounding busbar.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
1. Ground rods.
  2. Ground and roof rings.
  3. BCT, TMGB, TGBs, and routing of their bonding conductors.
- B. Qualification Data: For **Installer**, installation supervisor, and field inspector.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

## 1.6 QUALITY ASSURANCE

### A. Installer Qualifications:

1. Installation Supervision: Installation shall be under the direct supervision of ITS **Technician** who shall be present at all times when Work of this Section is performed at Project site.
2. Field Inspector: Currently registered by BICSI as an **RCDD** to perform the on-site inspection.

## PART 2 - PRODUCTS

### 2.1 SYSTEM COMPONENTS

- A. Comply with J-STD-607-A.

### 2.2 CONDUCTORS

- A. Comply with UL 486A-486B.

- B. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
2. Cable Tray Equipment Grounding Wire: **No. 6 AWG.**

- C. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmils (14.2 sq. mm), 14 strands of No. 17 AWG conductor, and 1/4 inch (6.3 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

### 2.3 CONNECTORS

- A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

- B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

- C. Busbar Connectors: Cast silicon bronze, solderless **compression**-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.
- D. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

## 2.4 GROUNDING BUSBARS

- A. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, **1/4 by 4 inches** in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-A.
  - 1. Predrilling shall be with holes for use with lugs specified in this Section.
  - 2. Mounting Hardware: Stand-off brackets that provide a **4-inch** clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
  - 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- B. TGB: Predrilled rectangular bars of hard-drawn solid copper, **1/4 by 2 inches** in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.
  - 1. Predrilling shall be with holes for use with lugs specified in this Section.
  - 2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch ((50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
  - 3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-A. Predrilling shall be with holes for use with lugs specified in this Section.
  - 1. Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
  - 2. Rack-Mounted Horizontal Busbar: Designed for mounting in 19- or 23-inch (483- or 584-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
  - 3. Rack-Mounted Vertical Busbar: 72 or 36 inches ((1827 or 914 mm) long, with) stainless-steel or copper-plated hardware for attachment to the rack.

## 2.5 GROUND RODS

- A. Ground Rods: **Copper-clad; 3/4 inch by 10 feet** in diameter.

## 2.6 LABELING

- A. Comply with TIA 606 and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.



- B. Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the ac grounding system measured at the point of BCT connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.
- B. Comply with NECA 1.
- C. Comply with J-STD-607-A.

#### 3.3 APPLICATION

- A. Conductors: Install solid conductor for **No. 8** AWG and smaller and stranded conductors for **No. 6** AWG and larger unless otherwise indicated.
  - 1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than **No. 6** AWG.
  - 2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than **No. 6** AWG.
- B. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.
- C. Conductor Support:
  - 1. Secure grounding and bonding conductors at intervals of not less than 36 inches ((900 mm).)

D. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch (900-mm) intervals.
4. Install grounding and bonding conductors in 3/4-inch (21-mm) PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
  - a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.

3.4 GROUNDING ELECTRODE SYSTEM

- A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than **No. 3/0 AWG**.

3.5 GROUNDING BUSBARS

- A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 12 inches (300 mm) above finished floor unless otherwise indicated.
- B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.6 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than **No. 6 AWG**.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
  1. Use crimping tool and the die specific to the connector.
  2. Pretwist the conductor.
  3. Apply an antioxidant compound to all bolted and compression connections.
- D. Primary Protector: Bond to the TMGB with insulated bonding conductor.
- E. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot (1 sq. mm/linear meter) of conductor

length, up to a maximum size of No. 3/0 AWG **168 kcmils (85 sq. mm)** unless otherwise indicated.

- F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install **top-mounted** rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.
- G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.
- H. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.
- I. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA 568 when grounding screened, balanced, twisted-pair cables.
- J. Rack and Cabinet Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.
- K. Access Floors: Bond all metal parts of access floors to the TGB.

### 3.7 IDENTIFICATION

- A. Labels shall be preprinted or computer-printed type.
  - 1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.
  - 2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
  - 3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

### 3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  - 2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.

- a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
    - a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB. Maximum acceptable ac current level is 1 A.
- C. Excessive Ground Resistance: If resistance to ground at the BCT exceeds **5** ohms, notify Architect promptly and include recommendations to reduce ground resistance.
  - D. Grounding system will be considered defective if it does not pass tests and inspections.
  - E. Prepare test and inspection reports.

END OF SECTION 270526

## SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Metal conduits and fittings.
  2. Nonmetallic conduits and fittings.
  3. Optical-fiber-cable pathways and fittings.
  4. Surface pathways.
  5. Boxes, enclosures, and cabinets.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets.

### PART 2 - PRODUCTS

#### 2.1 METAL CONDUITS AND FITTINGS

- A. General Requirements for Metal Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Comply with TIA-569.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
  2. Fittings for EMT:
    - a. Material: **Steel**.
    - b. Type: **Setscrew or compression**.
  3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

- F. Joint Compound for GRC or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. General Requirements for Nonmetallic Conduits and Fittings:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Comply with TIA-569.
- B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. Continuous HDPE: Comply with UL 651B.
- D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Description: Comply with UL 2024; flexible-type pathway, approved for **plenum, riser or general-use** installation unless otherwise indicated.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Comply with TIA-569.

## 2.4 SURFACE PATHWAYS

- A. General Requirements for Surface Pathways:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Comply with TIA-569.
- B. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

## 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets:
  - 1. Comply with TIA-569.
  - 2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

- B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, **aluminum**, Type FD, with gasketed cover.
- D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- E. Metal Floor Boxes:
  - 1. Material: **Cast metal or sheet metal**.
  - 2. Type: **Fully adjustable**.
  - 3. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, **cast aluminum** with gasketed cover.
- H. Device Box Dimensions: **4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)**.
- I. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, **Type 1 OR Type 3R** with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- K. Cabinets:
  - 1. NEMA 250, **Type 1 or Type 3R** galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.
  - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## PART 3 - EXECUTION

### 3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
  - 1. Exposed Conduit: **GRC**.
  - 2. Concealed Conduit, Aboveground: **GRC, EMT, RNC, Type EPC-40-PVC**.
  - 3. Boxes and Enclosures, Aboveground: NEMA 250, **Type 3R**.

- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: **EMT**.
  2. Exposed, Not Subject to Severe Physical Damage: **EMT**
  3. Exposed and Subject to Severe Physical Damage: GRC.
  4. Concealed in Ceilings and Interior Walls and Partitions: **EMT**
  5. Damp or Wet Locations: GRC.
  6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: **Plenum-type, optical-fiber-cable pathway, Plenum-type, communications-cable pathway, or EMT**.
  7. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: **EMT**.
  8. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 **stainless steel** in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 3/4-inch (21-mm) trade size. Minimum size for optical-fiber cables is 1 inch (27 mm).
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. EMT: Use **setscrew or compression, steel or cast-metal** fittings. Comply with NEMA FB 2.10.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F (49 deg C)**.

### 3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- D. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.
- E. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- F. Stub-ups to Above Recessed Ceilings:
1. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.



- G. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- H. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- I. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- J. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- K. Spare Pathways: Install pull wires in empty pathways. Cap underground pathways designated as spare above grade alongside pathways in use.
- L. Surface Pathways:
  - 1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
- M. Pathways for Optical-Fiber and Communications Cable: Install pathways as follows:
  - 1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
  - 2. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
  - 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements.
- N. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound.
- O. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where an underground service pathway enters a building or structure.
  - 3. Where otherwise required by NFPA 70.
  - 4. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
  - 5. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  - 6. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- P. Mount boxes at heights indicated on Drawings in accordance with ADA requirements. Install boxes with height measured to **center** of box unless otherwise indicated.

- Q. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

### 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

### 3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

### 3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.

END OF SECTION 270528

## SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Grounding.

B. Related Requirements:

1. Section 271500 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

#### 1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of a Commercial Installer.
2. Installation Supervision: Installation shall be under the direct supervision of a BICSI Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.
4. Contractor shall be certified under Belden's 25-year certification.

## PART 2 - PRODUCTS

### 2.1 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

### 2.2 EQUIPMENT FRAMES

- A. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

- B. Floor-Mounted Racks: Modular-type, steel or aluminum construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug.
2. Baked-polyester powder coat finish.

- C. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

### 2.3 POWER STRIPS

- A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. Six, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R receptacles.
4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.
6. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
7. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
8. Close-coupled, direct plug-in line cord.
9. Rocker-type on-off switch, illuminated when in on position.
10. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

## 2.4 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
  - 1. Refer to drawings for bus bar requirements.
- C. Comply with J-STD-607-A.

## 2.5 LABELING

- A. Comply with TIA 606 and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## PART 3 - EXECUTION

### 3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground pathways.

### 3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
  - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
  - 2. Record agreements reached in meetings and distribute them to other participants.
  - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
  - 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

- E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

### 3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

### 3.4 FIRESTOPPING

- A. Comply with TIA-569, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
  - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA 606. Comply with requirements in Division 26.
- B. Comply with requirements in Division 09 for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA 606 for Class 2 level of administration.
- D. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

## SECTION 27 13 00 - COMMUNICATIONS BACKBONE CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Pathways.
  2. UTP cable.
  3. Cable connecting hardware, patch panels, and cross-connects.
  4. Cabling identification products.

#### 1.2 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA 568, when tested according to test procedures of this standard.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
  2. Cabling administration drawings and printouts.
  3. Wiring diagrams to show typical wiring schematics including the following:
    - a. Cross-connects.
    - b. Patch panels.
    - c. Patch cords.
  4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
  5. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Layout Responsibility: Preparation of Shop Drawings by approved by a BICSI certified RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of a **BICSI Level 2 Installer**, who shall be present at all times when Work of this Section is performed at Project site.
  - 3. Contractor shall be certified under Belden's 25-year certification. Must contractor must be certified at least 6 months prior to bid.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: **25** or less.
  - 2. Smoke-Developed Index: **50** or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Telecommunications Pathways and Spaces: Comply with TIA 569.
- E. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Cable Support: NRTL labeled for support of Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.



1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.
4. Refer to 270536 for cable/ladder tray requirements.

B. Conduit and Boxes: Comply with requirements in Electrical Specifications.

## 2.2 BACKBOARDS

A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

## 2.3 UTP CABLE

A. Description: 250-ohm, 4-pair UTP, formed into 12 cable groups covered with a **gray** thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA 568 for performance specifications.
3. Comply with TIA 568, **Category 6A**.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
  - a. Communications, General Purpose: Type CM or CMG; **or MPP, CMP, MPR, CMR, MP, or MPG.**
  - b. Communications, Plenum Rated: Type CMP **or MPP**, complying with NFPA 262.
  - c. Communications, Riser Rated: Type CMR; **or MPP, CMP, or MPR**, complying with UL 1666.

## 2.4 UTP CABLE HARDWARE

A. General Requirements for Cable Connecting Hardware: Comply with TIA 568, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

B. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair **conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.**

C. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

D. Patch Cords: Factory-made, 4-pair cables in lengths as required by IT personnel; terminated with 8-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6A performance. Patch cords shall have latch guards to protect against snagging.

2. Patch cords shall have color-coded boots for circuit identification.

## 2.5 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

## 2.6 IDENTIFICATION PRODUCTS

- A. Comply with TIA 606 and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.7 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA 568.
- C. Factory test UTP cables according to TIA 568.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

### 3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
  1. Install plenum cable in environmental air spaces, including plenum ceilings.
  2. Comply with requirements for raceways and boxes specified in Electrical Specifications.
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

### 3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA 569.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA 569 for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Electrical Specifications for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits **3 inches (76 mm)** above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### 3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA 568.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Install 110-style IDC termination hardware unless otherwise indicated.
  - 4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
  - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
  11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA 568.
  2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than **60 inches (1524 mm)** apart.
  3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA 569 recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
  4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

### 3.5 FIRESTOPPING

- A. Comply with TIA 569, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA 606. Comply with requirements for identification specified in Electrical Specifications.
  1. Administration Class: **1**.
  2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Division 09 for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA 606 for Class 2 level of administration.
- D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, **backbone pathways and cables**, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
  - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
  - b. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect UTP jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA 568.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
  - a. Test instruments shall meet or exceed applicable requirements in TIA 568. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

- D. Prepare test and inspection reports.

END OF SECTION 271300

## SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Cable connecting hardware, patch panels, and cross-connects.
3. Telecommunications outlet/connectors.
4. Cabling system identification products.

B. Related Requirements:

1. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.

#### 1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
2. Wiring diagrams to show typical wiring schematics, including the following:
  - a. Cross-connects.
  - b. Patch panels.
  - c. Patch cords.
3. Cross-connects and patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.



- C. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications:

1. Layout Responsibility: Preparation of Shop Drawings by BICSI certified RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of a **BICSI Level 2 Installer**, who shall be present at all times when Work of this Section is performed at Project site.
3. Contractor shall be certified under Belden's 25-year certification.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

### PART 2 - PRODUCTS

#### 2.1 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
  1. TIA 568 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
  3. Bridged taps and splices shall not be installed in the horizontal cabling.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA 568 when tested according to test procedures of this standard.
- B. 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: **50** or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Grounding: Comply with J-STD-607-A.

## 2.3 BACKBOARDS

- A. Backboards: Plywood, **fire-retardant treated**, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

## 2.4 UTP CABLE

- A. Description: 100-ohm, four-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.
  - 1. Comply with ICEA S-90-661 for mechanical properties.
  - 2. Comply with TIA 568 for performance specifications.
  - 3. Comply with TIA 568 **Category 6A**.
  - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    - a. Communications, General Purpose: Type CM or CMG.
    - b. Communications, Plenum Rated: Type CMP complying with NFPA 262.
    - c. Communications, Riser Rated: Type CMR, complying with UL 1666.

## 2.5 UTP CABLE HARDWARE

- A. General Requirements for Cable Connecting Hardware: Comply with TIA 568, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- B. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
  - 1. Number of Jacks per Field: **One** for each four-pair **conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria**.
- C. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- D. Patch Cords: Factory-made, four-pair cables in lengths as required by IT personnel; terminated with eight-position modular plug at each end.
  - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6A performance. Patch cords shall have latch guards to protect against snagging.
  - 2. Patch cords shall have color-coded boots for circuit identification.

## 2.6 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA 568.

- B. Workstation Outlets: **Two**-port-connector assemblies mounted in **multigang** faceplate.
  - 1. Plastic Faceplate: High-impact plastic. Coordinate color with Electrical Specifications.
  - 2. Metal Faceplate: **Stainless steel** complying with requirements in Electrical Specifications.
  - 3. For use with snap-in jacks accommodating any combination of UTP work area cords.
    - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
  - 4. Legend: Factory labeled by silk-screening or engraving **for stainless steel faceplates**.
  - 5. Legend: Machine printed, in the field, using adhesive-tape label.
  - 6. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

## 2.7 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with J-STD-607-A.

## 2.8 IDENTIFICATION PRODUCTS

- A. Comply with TIA 606 and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Electrical Specifications.

## 2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP cables on reels according to TIA 568.
- C. Factory test UTP cables according to TIA 568.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

### 3.2 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters **and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used.** Conceal pathways and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements in Section 270528 "Pathways for Communications Systems."
  - 3. Comply with requirements in Section 270536 "Cable Trays for Communications Systems."
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
  - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
  - 2. Install lacing bars and distribution spools.
  - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

### 3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA 568.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Install 110-style IDC termination hardware unless otherwise indicated.
  - 4. MUTOA shall not be used as a cross-connect point.
  - 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
    - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    - b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
  - 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  - 9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
  - 10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  12. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
  13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA 568.
  2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than **60 inches (1524 mm)** apart.
  3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA 569 for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
  4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

### 3.4 FIRESTOPPING

- A. Comply with TIA 569, Annex A, "Firestopping."
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA 606. Comply with requirements for identification specified in Electrical Specifications.
  1. Administration Class: **1**.
  2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Division 09 for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA 606 for **Class 2** level of administration.
- D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, **backbone pathways and cables**, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment

grounding conductors. Follow convention of TIA 606. Furnish electronic record of all drawings, in software and format selected by Owner.

F. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
  - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
  - b. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

### 3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect UTP jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA 568.
2. Visually confirm **Category 6A**, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
  - a. Test instruments shall meet or exceed applicable requirements in TIA 568. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. UTP Performance Tests:

- a. Test for each outlet and MUTOA. Perform the following tests according to TIA 568:
  - 1) Wire map.
  - 2) Length (physical vs. electrical, and length requirements).
  - 3) Insertion loss.
  - 4) Near-end crosstalk (NEXT) loss.
  - 5) Power sum near-end crosstalk (PSNEXT) loss.
  - 6) Equal-level far-end crosstalk (ELFEXT).
  - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
  - 8) Return loss.
  - 9) Propagation delay.
  - 10) Delay skew.
6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
  - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
  - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.8 DEMONSTRATION

- A. **Train** Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 271500



## **SECTION 30 11 10 - ENVIRONMENTAL PROTECTION**

### **1.01 SCOPE OF WORK**

- A. The Work covered by this Section consists of furnishing all labor, materials and equipment and performing all Work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations under this Contract. For the purpose of this Specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorable alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and/or recreational purposes; or violate any applicable environmental laws, rules, codes or regulations.
- B. The control of environmental pollution requires consideration of air, water and land, and involves management of noise, odor, and solid waste, as well as other pollutants.
- C. These Specifications are intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and surroundings. These are general guidelines. It is the CONTRACTOR'S responsibility to determine the specific construction techniques to meet these guidelines.
- D. The CONTRACTOR shall secure, if required, at its own cost, a surface water management permit from the Northwest Florida Water Management District (NWFWM) and approvals from Bay County for any construction dewatering activities associated with this project.

### **1.02 APPLICABLE REGULATIONS**

The CONTRACTOR shall comply with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement.

### **1.03 NOTIFICATIONS**

The OWNER through the PROJECT REPRESENTATIVE will notify the CONTRACTOR in writing immediately following identification of any non-compliance with the foregoing provisions or of any environmentally objectionable acts and any required corrective action to be taken by CONTRACTOR. State or local agencies responsible for verification of certain aspects of the environmental protection requirements may notify the CONTRACTOR of any non-compliance with State or local requirements.

The CONTRACTOR shall, after receipt of such notice from the regulatory agency shall immediately notify the PROJECT REPRESENTATIVE in writing and immediately take correction action. If the CONTRACTOR fails or refuses to comply promptly, the OWNER may issue an order stopping all or part of the Work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the CONTRACTOR unless it is later determined that the CONTRACTOR was in compliance and subject to the other terms of the Contract Documents.

### **1.04 IMPLEMENTATION**

- A. Prior to commencement of the Work, the CONTRACTOR shall meet with the PROJECT REPRESENTATIVE to develop mutual understandings relative to compliance with this

specification and administration of the environmental pollution control program.

- B. The CONTRACTOR shall remove temporary environmental control features, when approved by the PROJECT REPRESENTATIVE, and incorporate permanent control features into the Project at the earliest practicable time, consistent with the approved construction schedule.

#### 1.05 EROSION CONTROL

- A. The CONTRACTOR shall ensure sufficient precautions are taken during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride, or other polluting materials harmful to humans, fish, or other life, into the supplies and surface waters of the State. Control measures must be adequate to assure that turbidity in the receiving water will not be increased more than 10 nephelometric turbidity units (NTU), or as otherwise required by the State or other controlling body, in water used for public water supply or fish unless limits have been established for the particular water. In surface water used for other purposes, the turbidity must not exceed 25 NTU unless otherwise permitted. Special precautions shall be taken in the use of construction equipment to prevent operations which promote erosion.

Erosion evident within the limits of construction shall be the responsibility of the CONTRACTOR during the full term of the Contract and for the full 1 year guarantee period. Areas subject to erosion during this time shall be fully restored to original or design conditions (as applicable) within 10 days of notice to the CONTRACTOR.

- B. The CONTRACTOR shall provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion control measures, such as siltation basins, hay check dams, mulching, jute netting and other equivalent techniques, shall be used as appropriate. Flow of surface water into excavated areas shall be prevented.

Ditches around construction area shall be used to carry away water resulting from dewatering of excavated areas. At the completion of the Work, ditches shall be backfilled and the ground surface restored to original condition.

- C. The CONTRACTOR shall schedule and conduct all Work in a manner that will minimize the erosion of soils in the area of the Work. Erosion control measures shall be provided such as diversion channels, sedimentation or filtration systems, berms, staked hay bales, seeding, mulching or other special surface treatments as are required by regulatory authorities to prevent silting and muddying of streams, rivers, canals, impoundments, lakes, etc. All erosion control measures shall be in place prior to any construction activity in any area of the Work.

#### 1.06 PROTECTION OF LAND RESOURCES

- A. Land resources within the Project boundaries and outside the limits of permanent Work shall be restored by CONTRACTOR to a condition, after completion of construction that will appear to be natural and not detract from the appearance of the project.
- B. Outside of areas requiring earthwork for the construction of the new facilities, the CONTRACTOR shall not deface, injure, or destroy trees or shrubs, nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the PROJECT

REPRESENTATIVE. Where such special emergency use is permitted, first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The CONTRACTOR shall in any event be responsible for any damage resulting from such use.

- C. Where trees may possibly be defaced, bruised, injured, or otherwise damaged by the CONTRACTOR'S equipment, dumping or other operations, CONTRACTOR shall protect such trees by placing board, planks, or poles around them. Monuments and markers shall be similarly protected by CONTRACTOR before beginning operations near them.
- D. Any trees or other landscape feature scarred or damaged by the CONTRACTOR'S equipment or operations shall be restored as nearly as possible to its original condition. The PROJECT REPRESENTATIVE will decide what method of restoration shall be used and whether damaged trees shall be treated and healed or removed and disposed of.

All scars made on trees by CONTRACTOR's equipment, construction operations, or by the removal of limbs by CONTRACTOR larger than 1 inch in diameter shall be coated as soon as possible with an approve tree wound dressing.

All trimming or pruning by CONTRACTOR shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.

Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the CONTRACTOR and are beyond saving in the opinion of a certified nurseryman, shall be immediately removed and replace in kind and maintained until growth is assured.

- E. The locations of the CONTRACTOR's lay down area, storage and other construction buildings, required temporarily in the performance of the Work, shall require written concurrence of the PROJECT REPRESENTATIVE. The preservation of the landscape and public perception shall be an imperative consideration in the selection of the lay down area and in the provision of any buildings. Drawings showing the lay down area and any buildings shall be submitted by CONTRACTOR for approval of the PROJECT REPRESENTATIVE.
- F. If temporary roads or embankments and excavations for plant and/or work areas are proposed, the CONTRACTOR shall submit the following for approval by the PROJECT REPRESENTATIVE at least ten days prior to scheduled start of such temporary work.
  - 1. A layout of all temporary roads, excavations and embankments to be constructed within the work area.
  - 2. Details of temporary road construction.
  - 3. Drawings and cross sections of proposed embankments and their foundations, including a description of proposed materials.
  - 4. A landscaping drawing showing the proposed restoration of the area. Removal of any trees and shrubs outside the limits of existing clearing area shall be indicated. The drawing shall also indicate location of required guard posts or barriers required to control vehicular traffic passing close to trees and shrubs to be maintained undamaged. The drawing shall provide for the obliteration of construction scars as

such and shall provide for a natural appearing final condition of the area. Modification of the CONTRACTOR'S approved drawings shall be made only with the written concurrence of the PROJECT REPRESENTATIVE.

No unauthorized road construction, excavation or embankment construction including disposal areas will be permitted. The CONTRACTOR shall remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess materials, or any other vestiges of construction as requested by the PROJECT REPRESENTATIVE. Any construction disturbed area shall be restored to near natural conditions.

- G. All debris and excess material will be disposed of by CONTRACTOR outside wetland or floodplain areas in an environmentally sound and lawful manner.

#### 1.07 PROTECTION OF AIR QUALITY

- A. The use of burning for the disposal of refuse and debris will not be permitted.
- B. The CONTRACTOR shall maintain all excavations, embankment, stockpiles, access roads, plant sites, waste areas, borrow areas, and all other work areas within or without the project boundaries free from dust which could cause the standards for air pollution to be exceeded, and which would cause a hazard or nuisance to others.
- C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of petroleum products is prohibited. The use of chlorides may be permitted with concurrence from the appropriate regulatory authority.
- D. Sprinkling must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the CONTRACTOR must have sufficient competent equipment on the job to accomplish needed sprinkling. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

#### 1.08 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION

During the life of this Contract, CONTRACTOR shall maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created. All pollution control devices shall be inspected regularly to ensure they are operating correctly.

#### 1.09 NOISE CONTROL

- A. The CONTRACTOR shall make every effort to minimize noises caused by operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with State and Federal Regulations.
- B. Sound levels measured by the PROJECT REPRESENTATIVE shall not exceed 55 dBA from 8:00 PM to 7:00 AM or 65 dBA from 7:00 AM to 8:00 PM. This sound level to be measured at the OWNER'S property line. Sound levels of equipment shall not exceed 95 dBA at any time. Sound levels in excess of these values are sufficient cause to have the Work halted until equipment can be quieted to acceptable levels. Work stoppage for excessive noise shall not relieve the CONTRACTOR of the other portions of this specification including, but not limited to Contract Time and Contract Price.

BAY COUNTY JAIL  
SUBSTANCE ABUSE UNIT  
Panama City, Florida

BID SET PROJECT MANUAL  
CONSTRUCTION DOCUMENTS  
FLA Project No. 4223-07

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

**END OF SECTION 301110**

## **SECTION 30 21 10 - SITE CLEARING**

### PART 1 - GENERAL

#### RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

#### DESCRIPTION OF WORK:

Extent of site clearing is shown on drawings.

Site clearing work includes, but is not limited to:

- Protection of existing trees.
- Removal of trees and other vegetation.
- Topsoil stripping.
- Clearing and grubbing.
- Removing above-grade improvements.
- Removing below-grade improvements.

#### JOB CONDITIONS:

**Traffic:** Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

**Protection of Existing Improvements:** Provide protection necessary to prevent damage to existing improvements indicated to remain in place.

- Protection improvements on adjoining properties and on Owner's property.

- Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

**Protection of Existing Trees and Vegetation:** Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

**Salvable Improvements:** Carefully remove items indicated to be salvaged, and store on Owner's premises where indicated or directed.

### PART 2 - PRODUCTS

Not applicable to work of this section.

### PART 3 - EXECUTION

#### SITE CLEARING:

General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions interfering with installation of new construction. Remove such items elsewhere on the site or premises as specifically indicated. Removal includes digging out stumps and roots.

Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.

Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4". Satisfactory topsoil is reasonably free of topsoil, clay lumps, stones, and other objects over 2" in diameter, and without weeds, roots, and other objectionable material.

Remove heavy growths of grass from areas before stripping.

Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to main root system.

Stockpile topsoil in storage piles in areas shown, or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind-blown dust.

Dispose of unsuitable or excess topsoil same as waste material, herein specified.

Clearing and Grubbing: Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.

Completely remove stumps, roots, and other debris protruding through the ground surface.

Use only hand methods for grubbing inside drip line of trees indicated to be left standing.

Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to a density equal to adjacent original ground.

Removal of Improvements: Remove existing above-grade and below-grade improvements necessary to permit construction, and other work as indicated.

#### DISPOSAL OF WASTE MATERIALS:

Burning on Owner's Property: Burning is not permitted on Owner's property unless Owner's approval is obtained and proper authorities are notified.

Removal from Owner's Property: Remove waste materials and unsuitable materials from Owner's property and dispose of off site in legal manner.

**END OF SECTION 30 21 10**

## **SECTION 31 22 00 - EARTHWORK**

### **PART 1 - GENERAL**

#### RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

#### DESCRIPTION OF WORK:

Definition: "Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

#### QUALITY ASSURANCE:

Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

Testing and Inspection Service: Employ, at Contractor's expense, a testing laboratory subject to approval by the Engineer to perform soil testing and inspection service for quality control during earthwork operations.

#### SUBMITTALS:

Test Reports-Excavating: Submit following reports directly to Engineer from the testing services; with copy to Contractor:

Test reports on fill material. (Modified Proctor Tests)

Field density test reports. (Modified Proctor Tests)

Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

#### JOB CONDITIONS:

Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner, and utility companies in keeping respective services and facilities in operation. Contractor shall bear all costs of repairing damaged utilities to the satisfaction of utility owner.

Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.

Provide minimum of 48-hour notice to engineer, and receive notice to proceed before interrupting any utility.

Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

Use of explosives: The use of explosives is not permitted.

Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

Operate warning lights as recommended by authorities having jurisdiction.



Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dryout in the manner prescribed in sections under "Sitework".

## PART 2 - PRODUCTS

### SOILS MATERIALS:

Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.

Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter. The fill material should be sand containing little fines. Prior to placing the fill material, the existing material shall be stripped of all soils containing a significant percentage of organics and all loose soils which cannot be readily compacted. If existing materials do not meet these requirements, it may be necessary to backfill with select materials other than those on the job site.

## PART 3 - EXECUTION

### EXCAVATION:

Excavation is Unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.

Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom of elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.

Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classifications, unless otherwise directed by engineer.

Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer who will make an inspection of conditions.

If unsuitable bearing materials are encountered at required subgrade elevations, notify Engineer who will make an inspection of conditions.

If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Engineer.

Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

Maintain sides and slopes of excavations in safe condition until completion of backfilling.

**Shoring and Bracing:** Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.

Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

**Dewatering:** Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. The cost of all dewatering operations including well pointing shall be the responsibility of the Contractor.

Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

**Material Storage:** Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

Dispose of excess soil material and waste materials as herein specified.

**Excavation for Structures:** Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of service, other construction, and for inspection.

In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

**Excavation for Trenches:** Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit and a maximum of 30" total width.

Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.

Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed stone or gravel prior to installation of pipe.

For pipes or conduit 5" or less in nominal size and for flat-bottomed multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cuts to accurate elevations and support pipe or conduit on undisturbed soil.

For pipes or conduit 6" or larger in nominal size, tanks and other mechanical/electrical work indicated to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6" below bottom of work to be supported.

Except as otherwise indicated, excavate for water bearing piping so top of piping is not less than 3'-0" below finished pavement grade, but no less than 2'-6" below finish grade.

Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.

Use care in backfilling to avoid damage or displacement of pipe systems.

#### COMPACTION:

General: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

All compaction requirements for this section are specified on the construction plans.

Moisture Control: Where subgrade of layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by dicing, harrowing or pulverizing, until moisture content is reduced to a satisfactory value.

#### BACKFILL AND FILL:

General: Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below:

In excavations, use satisfactory excavated or borrow material.

Under grassed areas, use satisfactory excavated or borrow material.

Under walks and pavements, use subbase material, or satisfactory excavated or borrow material, or combination of both.

Under piping and conduit, use subbase material where subbase is indicated under piping or conduit; shape to fit bottom 90 degrees of cylinder.

Backfill excavation as promptly as work permits, but not until completion of the following;

Acceptance of construction below finish grade.

Inspection, testing, approval, and recording locations of underground utilities.

Removal of concrete formwork.

Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities or leave in place if required.

Removal of trash and debris.

Permanent or temporary horizontal bracing is in place on horizontally supported walls.

Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break-up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

Placement and Compaction: The lower portion of backfill, to a compacted level of one foot above the top of the pipe, shall be hand placed in layers of lifts not to exceed six inches of compacted depth and each layer compacted individually by means of hand tampers. Above that level, place lifts in layers not to exceed twelve inches of compacted depth and machine filling and tamping may be used.

Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each lift to required percentage of minimum soil density for each area classification as designated herein. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

#### GRADING:

General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding.

Finish surfaces free from irregular surface changes, and as follows:

Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.

Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10' above or below required subgrade elevation.

Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2" above or below required subgrade elevations.

Grading Surface of Fill Under Building Slabs: Grade smooth and even, free from voids, compacted as specified, and to required elevation.

Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge.

Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage for each area classification.

#### FIELD QUALITY CONTROL:

Quality Control Testing During Construction: Provide testing service by a qualified soil testing firm, subject to Engineer's approval, to inspect and approve subgrades and fill layers before further construction work is performed.

Paved Areas: Make at least one field density test of subgrade for every 2000 square feet of paved area but in no case less than 3 tests, nor less than 1 per driveway or crossing. In each compacted fill layer, make one

field density test for every 2,000 square feet of paved area but in no case less than 3 tests, nor less than 1 per driveway or crossing.

Non-Paved Areas: Perform at least 1 field density test per 3,000 square feet of fill per every vertical foot of height, and perform at least 1 field density test per 1,000 feet of pipe installed per every 2 feet of vertical trench depth.

If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills which have been placed below are specified density, provide additional compaction and testing at no additional expense.

MAINTENANCE:

Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

Grassed Areas: See Section 02210, "Grassing" for requirements of grassed areas.

DISPOSAL OF EXCESS AND WASTE MATERIALS:

Disposal of all spoil material resulting from construction shall be the responsibility of the Contractor.

**END OF SECTION 31 22 00**

## SECTION 31 22 22 - TRENCHING, BACKFILLING AND COMPACTING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. The extent of trenching, backfilling and compacting is shown on the drawings.
- B. This section includes furnishing equipment, labor and materials, and performing all operations necessary and incidental to perform the required work.

### PART 2 - PRODUCTS

NOT USED

### PART 3 - EXECUTION

#### 3.1 CLEARING THE SITE

- A. The site of the work shall be cleared of all trees, shrubs, paving and objectionable material which interfere with the prosecution of the proposed work. Trees and shrubs which will not interfere with construction shall be protected from damage. Clearing shall be considered as an incidental item of excavation.

#### 3.2 EXCAVATION

- A. General: Perform excavation described of whatever substance encountered to the dimensions and depths specified or shown on the drawings. Undercutting will not be permitted, except when ordered by the Engineer. Material suitable for backfill shall be stockpiled near the site. Rock or other material undesirable for backfill shall be spoiled outside the area in a neat manner, as directed by the Engineer. Where it is necessary to cut roots projecting into an excavation or where it is necessary to trim branches for equipment clearance, all severed root ends or cuts to branches over 1/2-inch diameter shall be treated with an asphalt base pruning paint. Backfill over exposed roots as soon as possible.
- B. Rock: Where encountered in the trench bed, rock shall be excavated to a depth of 1/4 of the pipe diameter below the bottom of the pipe but in no case less than 4-inches. All undercut trench excavation shall be backfilled and tamped with materials as specified in the following paragraphs under Unstable Subgrade.
- C. Unstable Subgrade:
  - 1. In the event that unsuitable material is encountered at or below the excavation depth specified or shown on the drawings, the Engineer shall be notified. Such material shall be removed and replaced with suitable material. Methods and materials used for replacement shall be one of the following as directed by the Engineer in writing.
    - a. Suitable earth or sand, compacted in the trench. Materials shall be furnished as a part of the Bid Proposal item covering excavation and backfill.
    - b. Gravel or crushed limerock, compacted in the trench and paid for under the appropriate item.
    - c. Existing materials, stabilized after removal and then replaced and compacted in the trench at no additional cost to the Owner.

2. The Engineer shall determine the methods and materials to be used, based upon the condition of the excavation, the pipe structure to be supported, and the availability and character of stabilizing materials.

D. Trenches:

1. Keep pipe laying operation as close to the excavation operation as possible during the prosecution of the work. The Engineer reserves the right to stop the excavation at any time when, in his opinion, the excavation is opened too far in advance of the pipe laying.
2. Pipe trenches shall be excavated to a depth that will insure a minimum of 36-inches of cover for ductile iron and PVC pipe and 54-inches of cover for polyethylene pipe, except service laterals. Trenches shall be only of sufficient width to provide a free working space on each side of the pipe. To prevent excess pressure on the pipe, the maximum width of trench at the top of the pipe and at the bottom of the trench shall not be greater than 2-feet more than the greatest exterior diameter of the pipe. If this maximum width is exceeded, it shall be the Contractor's responsibility to provide, at no additional cost to the Owner, such additional bedding or select backfill materials as the Engineer may require. The excavation below the spring line shall be made to conform as near as possible to the shape of the lower third of the pipe. To protect the pipe lines from unusual stresses, all work shall be done in open trenches. Excavation shall be made for bells of all pipes and of sufficient depth to permit access to the joint for construction and inspections. In no case will the bells be used to support the body of the pipe.
3. In order to avoid existing utilities, at times it may be necessary for the pipe to be laid deeper than the minimum cover specified in the preceding paragraph. At such time the Contractor will not be allowed extra compensation for additional excavation involved.
4. In case excavation has been made deeper than necessary, a layer of concrete, fine gravel or other material satisfactory to the Engineer shall be placed, at no extra cost, to secure a firm foundation for the lower third of each pipe. Where possible, excavated material shall be placed so as not to interfere with public travel. Bridging shall be provided to afford necessary access to public or private premises. Bridging shall be considered as part of the excavation operation and shall be supplied at no additional cost to the Owner.

E. Structural: (For inlets, manholes, valve pits and similar structures)

1. Remove sufficient material to allow proper space for erecting and removing forms. The elevations of the bottoms of footings, if shown on the drawings, shall be considered as approximate only, and the Engineer may order, in writing, such changes in dimensions or elevations of footings as may be deemed necessary to secure a satisfactory foundation. Excavation for structures shall be sufficient to leave at least 12-inches in the clear between their outer surfaces and the embankment of timber that may be used to protect them. Backfill of earth under structures will not be permitted. Excess excavation for structures shall be filled with thoroughly compacted sand, gravel, or concrete at the expense of the Contractor.
2. After excavation for a structure is completed, the Contractor shall notify the Engineer to that effect. No concrete or reinforcing steel shall be placed until the Engineer has approved the depth of the excavation and the character of the foundation material.

F. Sheeting and Shoring:

1. The Contractor shall provide all trench and structural bracing, sheeting or shoring necessary to construct and protect the excavation, existing utilities, structures and private property of all types and as required for the safety of the employees. Sheeting shall be removed or cut off by the Contractor during backfilling operations as directed by the Engineer. Sheeting which is left in place by order of the Engineer will be paid for under the item, Lumber left in Place. Removal of shoring for structures shall be done in such a manner as not to disturb or mar finished masonry or concrete surfaces.

3.3 DRAINAGE

- A. Grading shall be controlled in the vicinity of excavations so that the surface of the ground will be properly sloped to prevent water from running into trenches or other excavated areas. Any water which accumulates in the excavations shall be removed promptly by well point or by other means satisfactory to the Engineer in such a manner as to not create a nuisance to adjacent property or public thoroughfare. Trenches shall be kept dry while pipe is being laid. Bridging of dewatering pipe shall be provided where necessary. Pumps and engines for well point systems shall be operated with mufflers, and at a minimum noise level suitable to a residential area. The Contractor will not be allowed to discharge water into the Owner's storm drainage system without the written approval of the Engineer. Approval will be subject to the condition that the storm sewer be returned to its original condition.
- B. The Contractor is responsible for carrying the water to the nearest ditch or body of water and for obtaining the necessary permission to use same. The Contractor shall be financially responsible for any nuisance created due to carrying off water from his drainage system.

3.4 BACKFILL

A. Trenches:

1. Trenches shall be backfilled immediately after the pipe is laid unless other protection for the pipeline is provided. Clean earth, sand, crushed limerock or other material approved by the Engineer shall be used for backfill. Backfill material shall be selected, deposited and compacted (simultaneously on both sides of the pipe) so as to eliminate the possibility of lateral displacement of the pipe. Backfill material shall solidly tamped around the pipes in layers to a level at least 1-foot above the top of the pipe. Each layer shall be compacted to a maximum thickness of 6-inches.
2. In unpaved areas, the remainder of the backfill shall be deposited and then compacted by puddling, water flooding or mechanical tampers. Mechanical tamping of layers in unpaved areas shall be to a maximum thickness of 12-inches. In areas to be paved or repaved, the entire depth of backfill shall be deposited in layers and compacted by hand or mechanical tampers to a maximum thickness of 6-inches. Compaction shall be carried out to achieve a density of at least 98% of the maximum density as determined by AASHTO, Method T-180. Under areas to be paved, puddling may be used for backfill consolidation after tamping to 1-foot over the pipe, as specified, provided the method is first approved by the Engineer and the density requirements are met.
3. In areas to be paved, density tests for determination of the specified compaction shall be made by a testing laboratory and spaced one in every 300-feet of trench cut. It is the intent of this specification to secure a condition where no further settlement of trenches will occur. When backfilling is completed, the roadway



base for pavement replacement may be placed immediately. It will be the responsibility of the Contractor to restore the surface to the original grade wherever settlement occurs.

B. Wet Trenches (Contractor's Option):

1. Backfill for the pipe bed in wet trenches shall be crushed, graded limerock, compacted in the trench. After the pipe is laid, a graded limerock backfill shall be placed and worked in around the haunches to a point 6-inches above the pipe. The width of the limerock material around the pipe shall not be less than the outside diameter of the pipe plus 6-inches on each side of the pipe. Material shall be carefully distributed along the pipe so as to provide full and uniform support under and around the pipe. Six inches above the top of the pipe and up to the water level, material from the excavations with no rock or earth exceeding 4-inches in any one dimension shall then be lifted to the trench and released at the water level. Material shall be uniformly distributed for the full width of the trench. Backfill and compaction above the water level in the trench shall be as specified above. All costs for graded limerock placed in wet trenches shall be included in the cost of stage excavation and backfill for the various sizes of pipe.

C. Bedding and Backfill - Flexible Sewer Pipe:

1. For polyvinyl chloride pipe, the bedding and backfill materials shall be such as to limit the vertical ring deflection to 5% of the inside pipe diameter. A deflection greater than 5% of the inside diameter shall be cause for rejection of the pipe.
2. Class IV or Class V materials as defined in ASTM D2321-74 shall not be used for bedding, haunching or initial backfill for flexible pipes.
3. For polyvinyl chloride plastic pipe, bedding shall be in accordance with ASTM D2321-74, using Class I, II or III materials, except under wet conditions. In any area where the pipe will be installed below existing or future groundwater levels or where the trench could be subject to inundation, Class I material shall be placed to the springline of the pipe.
4. A minimum of effort is needed to compact the material. However, in the initial stage of placing this type of material, take care to ensure that sufficient material has been worked under the haunch of the pipe to provide adequate side support. Take precautions to prevent movement of the pipe during placing of the material under the pipe haunch. Except for the protection of the pipe from large particles of backfill material, little care need be taken and no compaction is necessary in placing backfill material in the balance of the initial backfill area above the pipe. Where unstable trench wall exist because of migratory materials, such as water-bearing silts or fine sand, take care to prevent the loss of side support through the migratory action.
5. All bedding requirements for flexible pipe specified in the preceding paragraphs shall be included in the price bid for the applicable pipe material and no additional compensation for bedding material will be allowed.

D. Structural:

1. After completion of foundation footings and walls and other construction below the elevation of the final grades, and prior to backfilling, forms shall be removed and the excavation shall be cleared of all trash and debris. Material for backfilling shall consist of the excavation, borrow sand or other approved materials, and shall be free of trash, lumber or other debris. Backfill shall be placed in horizontal layers not in excess of 9-inches in thickness, and have a

moisture content such that a density may be obtained to prevent excessive settlement or shrinkage. Each layer shall be compacted by hand or approved machine tampers with extreme care being exerted not to damage pipe or structures. Backfill shall be placed and compacted evenly against the exposed surfaces to prevent undue stress on any surface.

### 3.5 RESTORATION OF SURFACE IMPROVEMENTS

- A. Roadways, including shoulders, alleys and driveways of shell, limerock, stabilized soil or gravel, grass plots, sod, shrubbery, ornamental trees, signs, fences, or other surface improvements on public or private property which have been damaged or removed in excavation, shall be restored to conditions equal to or better than conditions existing prior to beginning work. Restoration of shoulders shall consist of seeding and mulching or stabilizing with limerock as selected by the Engineer. The cost of doing this work shall be included in the cost of the various applicable items. Photographs as specified in Section 01380 - General Quality Control will be used as an aid in determining conditions prior to construction.
- B. Materials for unpaved roadways, road shoulders, alleys, or driveways, shall be compacted as described in the plans. The cost of this work and furnishing new materials shall be included in the cost of the applicable items of work as no separate payment will be made, unless a separate bid item is provided.

### 3.6 FINE GRADING

- A. Finished areas around structures shall be graded smooth and hand raked and shall meet the elevations and contours shown on the drawings. Lumber, earth clods, rocks and other undesirable materials shall be removed from the site.

### 3.7 DISPOSAL OF MATERIALS

- A. Such portions of the excavated materials as needed and as suitable, shall be used for backfilling and grading about the completed work to the elevations as shown on the drawings or as directed. Excavated material in excess of the quantity required for this purpose shall be disposed of by the Contractor in those areas designated by the Owner and as shown on the drawings. The Contractor shall leave the earth over the trenches or other excavations in a neat and uniform condition acceptable to the Owner.

### 3.8 PAVEMENT REPLACEMENT

- A. Asphalt pavement shall be removed by saw cutting on a straight line with edges as vertical as possible. Concrete pavement or asphalt surfaced concrete shall be removed by cutting with a concrete saw in as straight a line and vertically as possible. Materials to replace State Highway paving shall conform to the specifications required by the Florida Department of Transportation Specifications for Type S-I asphaltic concrete surface course, or as specifically shown in the plans.
- B. Prior to replacing concrete or asphalt pavement replacement, a limerock base shall be laid. The base for concrete pavement shall be 6-inches of compacted thickness, and that for asphalt pavement shall be 8-inches of compacted thickness. The base course for each shall be compacted to a minimum of 98% of the maximum density as determined by AASHTO, Method T-180. The Owner will have tests made by an independent testing laboratory to verify compaction results. One test will be made for each block of continuous trench cut.
- C. Non-asphalt pavement replacement shall be replaced of like material and thickness. Asphalt or built-up asphalt pavement shall be replaced with like material or concrete as directed by the Engineer. Where asphalt or built-up asphalt pavement is replaced by

concrete, the concrete shall have a minimum of 6-inches in thickness and be reinforced with 6 by 6 no. 6 gage welded wire fabric. Concrete for paving shall be 3,000 psi design strength. Where the pavement replacement is of like material, it shall be replaced in thickness equal to or better than that existing at the time of removal.

- D. Unless the base is sealed or other temporary paving applied over areas to be repaved, pavement shall be replaced not later than 3-weeks after completion of backfill.

### 3.9 TESTS

- A. The Contractor shall furnish facilities for making all density tests and make such restorations as may be necessary due to test operations. All density tests on backfill or base replacement will be made by a commercial testing laboratory employed by the Contractor and at such locations as may be recommended by the Engineer. If the densities as determined by the specified tests fall below the required minimums, the Contractor shall pay for all retests.

### 3.10 SIDEWALK, CURB AND GUTTER REMOVAL AND REPLACEMENT

- A. Sidewalk, curb and gutter removal and replacement required in the construction of this work shall be done by the Contractor. Reasonable care shall be exercised in removing sidewalk and curb and gutter, and the Contractor shall either stockpile or dispose of this material as directed by the Engineer. Brick, concrete or built-up asphalt sidewalk replacement and curb and gutter replacement shall be replaced of like material in a manner and condition equal to or better than that existing at the time of removal. Materials and methods of replacing State Highway sidewalks or curbs shall conform to the Department of Transportation specifications.

**END OF SECTION 31 22 22**

## **ASECTION 32 33 10 - CONCRETE WORK**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of concrete work is shown on Drawings.

#### **1.03 SUBMITTALS**

- A. Product Data:

- 1. Submit data proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by ENGINEER.

- B. Shop Drawings, Reinforcement:

- 1. Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement.
- 2. Comply with American Concrete Institute (ACI) 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement.
- 3. Include special reinforcement required for openings through concrete structures.

- C. The ENGINEER's review is for general engineering applications and features only. Design of formwork for structural stability and efficiency is the CONTRACTOR's responsibility.

- D. Laboratory Test Reports:

- 1. Submit laboratory test reports for concrete materials and mix design test.

#### **1.04 QUALITY ASSURANCE**

- A. Codes and Standards:

- 1. Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
  - a) ACI 301 "Specifications for Structural Concrete for Buildings."
  - b) ACI 318 "Building Code Requirements for Reinforced Concrete."
  - c) Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

- B. Concrete Testing Services:

- 1. A testing laboratory shall be engaged that is acceptable to the ENGINEER to perform material evaluation tests and to design concrete mixes.

2. Materials and installed work may require testing and retesting at anytime during progress of work.
3. Tests, including retesting of rejected materials for installed work, shall be done at the CONTRACTOR's expense.

#### 1.05 PROJECT CONDITIONS

##### A. Protect Footings Against Freezing:

1. Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against the possibility of freezing.
2. Maintain cover for time period as necessary.

##### B. Protect adjacent finish materials against spatter during concrete placement.

#### PART 2 - PRODUCTS

#### 2.01 FORM MATERIALS

##### A. Forms for Exposed Finish Concrete:

1. Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.

##### B. Use plywood complying with U. S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

##### C. Forms for Unexposed Finish Concrete:

1. Plywood, lumber, metal, or other acceptable material.
2. Provide lumber dressed on at least two edges and one side for tight fit.

##### D. Form Coatings:

1. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

##### E. Form Ties:

1. Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal.
2. Provide units which will leave no metal closer than 1 ½ inches to surface.
3. Provide ties which, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.

#### 2.02 REINFORCING MATERIALS

- A. Reinforcing Bars:
  - 1. American Society of Testing and Materials (ASTM) A 615
  - 2. Grade 60.
  - 3. Deformed.
- B. Steel Wire:
  - 1. ASTM A 82
  - 2. Plain.
  - 3. Cold-drawn steel.
- C. Welded Wire Fabric:
  - 1. ASTM A 185.
  - 2. Welded steel wire fabric.
- D. Welded Deformed Steel Wire Fabric:
  - 1. ASTM A 497.
- E. Supports for Reinforcement:
  - 1. Use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place.
  - 2. Use wire bar type supports complying with CRSI specifications.
- F. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

## 2.03 CONCRETE MATERIALS

- A. Portland Concrete:
  - 1. ASTM C 150, Type I.
  - 2. Use one brand of cement throughout project, unless otherwise acceptable to the ENGINEER.
- B. Normal Weight Aggregates:
  - 1. ASTM C 33, and as herein specified.
  - 2. Provide aggregates from a single source for exposed concrete.
  - 3. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
- C. Water:
  - 1. Drinkable.

## 2.04 RELATED MATERIALS

### A. Polyvinyl Chloride (PVC) Waterstops:

1. Corps of Engineers CRD-C 572.
2. Manufacturer: Subject to compliance with requirements, provide products of one of the following or equal:
  - a. AFCO Products.
  - b. The Burke Co.
  - c. Edoco Technical Products.
  - d. Greenstreet Plastic Products.
  - e. Harbour Town Products.
  - f. W. R. Meadows.
  - g. Progress Unlimited.
  - h. Schlegel Corp.
  - i. Vinylex Corp.

### B. Granular Base:

1. Use evenly graded mixture of fine and coarse aggregates to provide, when compacted, a smooth and even surface below slabs on grade.

### C. Vapor Retarder:

1. Provide vapor retarder cover over prepared base material where indicated below slabs on grade.
2. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows:
  - a. Polyethylene sheet not less than 8 mils thick.
  - b. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.
3. Products: Subject to compliance with requirements, provide one of the following or equal:
  - a. Metallic:

- 1) "Vibrofoil," A. C. Horn, Inc.
- 2) "Metallic Spec. Grout," The Burke Co.
- 3) "Embeco 636," Master Builders.
- 4) "Ferrolith GDS," Sonneborn-Rexnord.
- 5) "Hi-Mod Grout," Euclid Chemical Co.
- 6) "Kemox G," Sika Chemical Co.
- 7) "Ferrogrout," L & M Const. Chemical Co.
- 8) "Supreme Plus," Gifford-Hill/American Admixtures.

b. Non-Metallic:

- 1) "Set Grout," Master Builders.
- 2) "Sonogrout," Sonneborn-Rexnord.
- 3) "Euco-NS," Euclid Chemical Co.
- 4) "Supreme," Gifford-Hill/American Admixtures.
- 5) "Crystex," L & M Const. Chemical Co.
- 6) "Sure-Grip Grout," Dayton Superior Corp.
- 7) "Horngrout," A. C. Horn, Inc.
- 8) "Five Star Grout," U. S. Grout Corp.

D. Liquid Membrane-Forming Curing Compound:

1. Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class A.
2. Moisture loss not more than 0.055 grams per square centimeter (gr./sq. cm.) when applied at 200 square feet per gallon (sq. ft./gal).
3. Products: Subject to compliance with requirements, provide one of the following or equal:
  - a. "Masterseal," Master Builders.
  - b. "A-H 3 Way Sealer," Anti-Hydro Waterproofing Co.
  - c. "Ecocure," Euclid Chemical Co.
  - d. "Clear Seal," A. C. Horn, Inc.
  - e. "Sealco 309," Gifford-Hill/American Admixtures.



- f. "J-20 Acrylic Cure," Dayton Superior.
- g. "Spartan-Cote," The Burke Co.
- h. "Sealkure," Toch Div. – Carboline.
- i. "Kure-N-Seal," Sonneborn-Rexnord.
- j. "Polyclear," Upco Chemical/USM Corp.
- k. "L & M Cure," L & M Construction Chemicals.
- l. "Klearseal," Setcon Industries.
- m. "LR-152," Protex Industries.
- n. "Hardtop," Gifford-Hill.

## 2.05 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If a trial batch method is used, use an independent testing facility acceptable to the ENGINEER for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.
- B. Submit written reports to Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by the ENGINEER.
- C. Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:
  - 1. 4,000 pounds per square inch (psi) 28-day compressive strength; W/C ratio, 0.44 maximum (non-air-entrained).
  - 2. 3,000 psi 28-day compressive strength; W/C ratio, 0.58 maximum (non-air-entrained).
  - 3. 2,500 psi 28-day compressive strength; W/C ratio, 0.67 maximum (non-air-entrained).
- D. Lightweight Concrete:
  - 1. Proportion mix as herein specified.
  - 2. Design mix to produce strength and modulus of elasticity as noted on Drawings, with a split-cylinder strength factor (Fct) of not less than 5.5 for 3,000 psi concrete and a dry weight of not less than 95 pounds (lbs) or more than 110 lbs. after 28 days.
  - 3. Limit shrinkage to 0.03 percent at 28 days.
- E. Adjustment to Concrete Mixes:
  - 1. Mix design adjustments may be requested by the CONTRACTOR when characteristics of materials, job conditions, weather, test results, or other

circumstances warrant; at no additional cost to the OWNER and as accepted by the ENGINEER.

2. Submit laboratory test data for revised mix design and strength results to the ENGINEER for acceptance before using in work.
- F. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at Manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus-or-minus 1½ percent within the following limits:
- G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Ramps, slabs, and sloping surfaces: Not more than 3 inches.
  2. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.
  3. Concrete containing HRWR admixture (super-plasticizer): Not more than 8 inches after addition of HRWR to site-verified 2 to 3 inches slump concrete.
  4. Other concrete: Not less than 1 inch and not more than 4 inches.

## 2.06 CONCRETE MIXING

- A. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
- B. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

### 3.02 FORM

- A. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure.
- B. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position.
- C. Maintain formwork construction tolerances complying with ACI 347.
- D. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
- E. Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level, and plumb work in finished structures.
- F. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required for this Work.

- G. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
- H. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
- I. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.
- J. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.
- K. Provide Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
- L. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete.
  - 1. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar.
  - 2. Locate temporary openings on forms at inconspicuous locations.
- M. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- N. Provisions for Other Trades:
  - 1. Provide openings in concrete formwork to accommodate work of other trades.
  - 2. Determine size and location of openings, recesses, and chases from trades providing such items.
  - 3. Accurately place and securely support items built into forms.
  - 4. Other trades shall provide location and size of openings. The forms for such openings shall be constructed and set in place under this section.
- O. Cleaning and Tightening:
  - 1. Thoroughly clean forms and adjacent surfaces to receive concrete.
  - 2. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed.
  - 3. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

### 3.03 VAPOR RETARDER INSTALLATION

- A. Place vapor retarder sheeting with longest dimension parallel with direction of pour following the completion of leveling and tamping of granular base for slabs on grade.
- B. Lap joints 6 inches and seal with appropriate tape.

### 3.04 PLACING REINFORCEMENT

- A. Comply with CRSI's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.

- B. Avoid cutting or puncturing vapor retarder during reinforcement placement and concreting operations.
- C. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- D. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations.
- E. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- F. Place reinforcement to obtain at least minimum coverages for concrete protection.
  - 1. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.
  - 2. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- G. Install welded wire fabric in as long lengths as practicable.
  - 1. Lap adjoining pieces at least one full mesh and lace splices with wire.
  - 2. Offset end laps in adjacent widths to prevent continuous laps in either direction.

### 3.05 JOINTS

- A. Construction Joints:
  - 1. Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to the ENGINEER.
  - 2. Place construction joints perpendicular to main reinforcement.
  - 3. Continue reinforcement across construction joints, except as otherwise indicated.
- B. Waterstops:
  - 1. Provide waterstops in construction joints as indicated.
  - 2. Install waterstops to form continuous diaphragm in each joint.
  - 3. Make provisions to support and protect exposed waterstops during progress of work.
  - 4. Fabricate field joints in waterstops in accordance with Manufacturer's printed instructions.
- C. Isolation Joints in Slabs-on-Ground:
  - 1. Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

### 3.06 INSTALLATION OF EMBEDDED ITEMS

A. General:

1. Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete.
2. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

3.07 PREPARATION OF FORM SURFACES

- A. Clean re-used forms of concrete matrix residue, repair and patch as required returning forms to acceptable surface condition.
- B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- C. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound Manufacturer's directions.
- D. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed.
- E. Apply in compliance with Manufacturer's instructions.

3.08 CONCRETE PLACEMENT

A. Pre-Placement Inspection:

1. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in.
2. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.
3. Moisten wood forms immediately before placing concrete where form coatings are not used.
4. Apply temporary protective covering to lower 2 feet of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

B. General:

1. Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.
2. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has sufficiently hardened to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
3. Placing Concrete in Forms:
  - a. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints.

- b Where placement consists of several layers, place each layer while the preceding layer is still plastic to avoid cold joints.
  - c Consolidation of Concrete:
    - 1) Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping.
    - 2) Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
    - 3) Do not use vibrators to transport concrete inside forms.
    - 4) Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine.
    - 5) Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    - 6) Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
4. Placing Concrete Slabs:
- a Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
  - b Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - c Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface; free of humps or hollows.
  - d Do not disturb slab surfaces prior to commencement of finishing operations.
  - e Maintain reinforcing in proper position during concrete placement operations.
5. Cold Weather Placing:
- a Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
  - b When air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit (F)/4 degrees Celcius (C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 Degrees F (27 degrees C) at point of placement.
  - c Do not use frozen materials or materials containing ice or snow.

- d Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- e Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

6. Hot Weather Placing:

- a When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
- b Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F (32 degrees C).
- c Mixing water may be chilled or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water.
- d Use of liquid nitrogen to cool concrete is the CONTRACTOR's option.
- e Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the temperature of the steel does not exceed the ambient air temperature immediately before embedment in concrete.
- f Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
- g Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

3.09 FINISH OF FORMED SURFACES

A. Rough Form Finish:

- 1. For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated.
- 2. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth Form Finish:

- 1. For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material directly applied to the concrete, or a covering material directly applied to the concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system.
- 2. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams.
- 3. Repair and patch defective areas with fins or other projections completely removed and smoothed.

C. Grout Cleaned Finish:

1. Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment.
  2. Combine one part Portland cement to 1½ parts fine sand by volume, and mix with water to consistency of thick paint.
  3. Use proprietary additives at the CONTRACTOR's option.
  4. Blend standard Portland cement and white Portland cement (amounts determined by trial patches) so that final color of dry grout will match adjacent surfaces.
  5. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes.
  6. Remove excess grout by scraping and rubbing with clean burlap.
  7. Keep damp by fog spray for at least 36 hours after rubbing.
- D. Related Unformed Surfaces:
1. Strike-off smooth tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces and finish with a texture matching adjacent formed surfaces.
  2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.10 MONOLITHIC SLAB FINISHES

- A. ASTM E 1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the "F Number System (inch-pound-units)," shall be used for these finishes as follows:
1. Scratch Finish:
    - a. Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.
    - b. After placing slabs, plane surface to tolerances for floor flatness (FF) of 15 and floor levelness (FL) of 13.
    - c. Slope surfaces uniformly to drain where required.
    - d. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.
  2. Float Finish:
    - a. Apply float finish to monolithic slab surface to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.
    - b. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating.



- c. Begin floating when surface water has disappeared or when concrete has sufficiently stiffened to permit operation of power-driven floats, or both.
  - d. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units.
  - e. Check and level surface plane to tolerances of FF 18 - FL 15.
  - f. Cut down high spots and fill low spots.
  - g. Uniformly slope surfaces to drains.
  - h. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
3. Trowel Finish:
- a. Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.
  - b. After floating, begin first trowel finish operation using a power-driven trowel.
  - c. Begin final troweling when surface produces a ringing sound as trowel is moved over surface.
  - d. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of FF 20 - FL 17.
  - e. Grind smooth surface defects which would telegraph through applied floor covering system.
4. Trowel and Fine Broom Finish:
- a. Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.
5. Non-Slip Broom Finish:
- a. Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
  - b. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route.
  - c. Coordinate required final finish with the ENGINEER before application.

### 3.11 CONCRETE CURING AND PROTECTION

#### A. General:

- 1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.
3. Continuously keep concrete moist for not less than 7 days, weather permitting.
4. Begin final curing procedures immediately following initial curing and before concrete has dried.
5. Continue final curing for at least 7 days in accordance with ACI 301 procedures.
6. Avoid rapid drying at end of final curing period.

B. Curing Methods:

1. Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.
2. Provide moisture curing by the following methods:
  - a. Keep concrete surface continuously wet by covering with water.
  - b. Continuous water-fog spray.
  - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and continuously keeping wet.
  - d. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.
3. Provide moisture-cover curing as follows:
  - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive.
  - b. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
4. Provide curing slabs and sealing compounds to exposed interior slabs and to exterior slabs, walks, and curbs, as follows:
  - a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours).
  - b. Uniformly apply in continuous operation by power-spray or roller in accordance with Manufacturer's directions.
  - c. Recoat areas subjected to heavy rainfall within 3 hours after initial application.
  - d. Maintain continuity of coating and repair damage during curing period.
5. Do not use membrane curing compounds on surfaces that are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile and glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to the ENGINEER.

6. Curing Formed Surfaces:
  - a. Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed.
  - b. If forms are removed, continue curing by methods specified above, as applicable.
7. Curing Unformed Surfaces:
  - a. Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.
  - b. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.
8. Sealer and Dustproofer:
  - a. Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

### 3.12 SHORES AND SUPPORTS

- A. Remove shoring from ground to roof for structures four stories or less, unless otherwise permitted.
- B. Remove shores and re-shore in a planned sequence to avoid damage to partially cured concrete.
- C. Locate and provide adequate re-shoring to safely support work without excessive stress or deflection.
- D. Keep shores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

### 3.13 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at no less than 50 degrees F (10 degrees C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

### 3.14 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces.
- B. Apply new form coating compound as specified for new formwork.
- C. Thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints when forms are extended for successive concrete placement.
- D. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to the ENGINEER.

### 3.15 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In:
  - 1. Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place.
  - 2. Mix, place, and cure concrete as herein specified, to blend with in-place construction.
  - 3. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs:
  - 1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  - 1. Provide machine and equipment bases and foundations, as shown on Drawings.
  - 2. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of Manufacturer furnishing machines and equipment.
  - 3. Grout base plates and foundations as indicated, using specified non-shrink grout.
  - 4. Use non-metallic grout for exposed conditions, unless otherwise indicated.
- D. Reinforced Masonry:
  - 1. Provide concrete grout for reinforced masonry lintels and bond beams where indicated on Drawings and as scheduled, including filling of concrete modular unit cavities where called for on plans.
  - 2. Maintain accurate location of reinforcing steel during concrete placement.

### 3.16 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas:
  - 1. Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the ENGINEER.

2. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch.
  3. Make edges of cuts perpendicular to the concrete surface.
  4. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent.
  5. Place patching mortar after bonding compound has dried.
- B. Repair of Formed Surfaces:
1. Remove and replace concrete having defective surfaces if defects cannot be repaired to the satisfaction of the ENGINEER. Surface defects, as such, include:
    - a. Color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets.
    - b. Fins and other projections on surface.
    - c. Stains and other discolorations that cannot be removed by cleaning.
  2. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.
  3. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- C. Repair of Unformed Surfaces:
1. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish.
  2. Correct low and high areas as herein specified.
  3. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.
- D. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing cracks in excess of 0.01 inch wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
1. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
  2. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete.
  3. Finish repaired areas to blend into adjacent concrete.
  4. Proprietary patching compounds may be used when acceptable to the ENGINEER.
- E. Repair Defective Areas:

1. Cut out and replace with fresh concrete except random cracks and single holes not exceeding 1 inch in diameter.
  2. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least  $\frac{3}{4}$ -inch clearance all around.
  3. Dampen concrete surfaces in contact with patching concrete and apply bonding compound.
  4. Mix patching concrete of same materials to provide concrete of same type or class as original concrete.
  5. Place, compact, and finish to blend with adjacent finished concrete.
  6. Cure in same manner as adjacent concrete.
- F. Perform structural repairs with prior approval of Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.
- G. Use repair methods not specified above, subject to acceptance of the ENGINEER.

### 3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. The OWNER may employ a testing laboratory to perform tests and to submit test reports.
- B. Sampling and testing for quality control during placement of concrete may include the following, as directed by the ENGINEER.
1. Sampling Fresh Concrete:
    - a. ASTM C 172, except modified for slump to comply with ASTM C 94.
  2. Slump:
    - a. ASTM C 143, one test at point of discharge for each day's pour of each type of concrete and additional tests when concrete consistency seems to have changed.
  3. Concrete Temperature:
    - a. Test hourly when air temperature is 40 degrees F (4 degrees C) and below, and when 80 degrees F (27 degrees C) and above, and each time a set of compression test specimens are made.
  4. Compression Test Specimen:
    - a. ASTM C 31, one set of four standard cylinders for each compressive strength test, unless otherwise directed.
    - b. Cylinders for laboratory cured test specimens shall be molded and stored except when field-cure test specimens are required.
  5. Compressive Strength Tests:
    - a. ASTM C 39, one set for each day's pour exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any 1 day:

- 1) One specimen tested at 7 days.
  - 2) Two specimens tested at 28 days.
  - 3) One specimen retained in reserve for later testing if required.
- b. When frequency of testing will provide less than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
- C. Test results will be reported in writing to Structural Engineer and the CONTRACTOR within 24 hours after tests.
- D. Reports of compressive strength tests shall contain:
1. The project identification name and number.
  2. Date of concrete placement.
  3. Name of concrete testing service.
  4. Concrete type and class.
  5. Location of concrete batch in structure.
  6. Design compressive strength at 28 days.
  7. Concrete mix proportions and materials.
  8. Compressive breaking strength.
  9. Type of break for both 7- and 28-day tests.
- E. Nondestructive Testing:
1. Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- F. Additional Tests:
1. The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the ENGINEER.
  2. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
  3. The CONTRACTOR shall pay for such tests when unacceptable concrete is verified.

**END OF SECTION 32 33 10**

## **SECTION 32 92 00 - RESTORATION**

### **PART 1 - GENERAL**

#### 1.01 DESCRIPTION OF WORK

- A. The work includes the restoration of driveways, lawn areas, trees and plants, roadways, sprinkler systems, walks and any other existing improvement affected by the proposed work.
- B. This section includes furnishing equipment, labor and materials, and performing all necessary and incidental operations to perform the required work.

### **PART 2 – PRODUCTS**

#### 2.01 SOD

- A. Any slope equal to or steeper than 1 vertical to 3 horizontal shall be sodded and the sod shall be pinned down for stabilization.
- B. The CONTRACTOR shall, at his expense, maintain the sodded areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include watering, re-staking sod, filling, leveling and repairing of any washed or eroded areas, as may be necessary.

#### 2.02 PLANTS AND TREES

- A. Existing damaged plants and trees shall be replaced by plants and trees of equal type, quality and size whenever possible. All new plants and trees shall be sound, healthy, vigorous and free from defects, decay, disfiguring, bark abrasions, plant diseases, insect pests, their eggs or larvae. The new plants shall be approved by the ENGINEER before placing.
- B. Existing plants may be removed, preserved, and replaced at the CONTRACTOR's option. Plants shall be handled by an approved nursery.
- C. Plants shall be watered and cared for until new growth appears. Dead and dying plants shall be immediately replaced. Plants used shall be in accordance with the standards for Florida No. 1 or better as given in Grades and Standards for Nursery Plants Part 1.
- D. Plants shall conform to the sizes indicated by the OWNER.
- E. Trees shall be guaranteed for one year. If the replaced tree dies within one year of project completion it shall be replaced by the CONTRACTOR at no expense to the City.

#### 2.03 MULCH

- A. Match existing mulch.

#### 2.04 WATER

- A. The water used in the performance of this Contract shall be of drinking water quality, clean and free from injurious amounts of oil, acid, alkali, or organic matter. The



CONTRACTOR shall purchase all testing water from the County.

2.05 PLANTING MIXTURE:

- A. The 18 inch planting mixture, when required, shall consist of a thorough mixture of 40% peat and 60% sand. The peat shall be Florihome peat or equivalent and the sand shall be clean and free from debris of any kind.

2.06 FERTILIZER

- A. Fertilizer shall be pelletized 13-13-13, or approved equal.

**PART 3 - EXECUTION**

3.01 LANDSCAPING RESTORATION

- A. Lawn Areas: Any lawn area affected by the required work shall be restored to a condition equal or better than the conditions existing before the commencement of work.
- B. Balled Plants: Plants where required shall be adequately balled with firm natural balls of soil, sized as set forth in "Horticultural Standards." Balls shall be firmly wrapped with burlap or equally approved strong cloth. No balled plant will be planted if the ball is cracked or broken before or during the process of planting.
- C. Preparation of Plant Pits: All plant pits shall be circular in outline and have vertical sides. Tree pits shall be two feet wider than the width of the ball and one foot deeper than the depth of the ball. Shrubs that are either B&B or 3 gallons + shall have pits that are two feet wider than the width of the plant ball and 6 inches deeper than the depth of the ball. Smaller shrubs shall have pits that are at least one foot wider than the width of the plant ball and 6 inches deeper than the ball depth.
- D. Setting Plants: All plants except as otherwise specified, shall be centered in pits. Deep planting shall be avoided and unless otherwise specified, plants shall be set at such a level that after settlement they will bear the same relation to the required grade as they have to the natural grade before being transplanted.
- E. Balled and burlapped plants and palm trees shall be placed on 6 inches to 12 inches of tamped planting mixture and adjusted so as to be at the proper level. The rope and burlap shall be cut away and the burlap folded down to the bottom of the pit. Very large B&B plants shall remain wrapped until fully backfilled and then just the upper portion of the burlap shall be removed. Backfill of planting mix shall be placed halfway up the pit and then water tamped. After this water has drained away, backfill around the ball to grade and water tamp again. Finally, form a ridge of soil around the edge of the pit to form a saucer and full area three times with water.
- F. Water: Water to be used initially during plant installation shall be furnished by the CONTRACTOR. The existing irrigation system, where damaged, shall be promptly repaired after the installation of the plants.
- G. Options as to Methods: Any plant may be furnished container grown instead of balled if all other requirements are met.
- H. Immediately before sod is placed, 8-8-8 fertilizer shall be applied at the rate of approximately 500 pounds per acre, by broadcasting and raking into the planting area.

- I. Sod shall be firmly embedded by light tamping. Wherever necessary to prevent an erosion condition caused by vertical edges at the outer limits of the sodded area, the sod shall be tamped so as to produce a featheredge at the outer limits. The sod shall be kept in a moist condition after it is planted. Water shall not be applied between the hours of 8 A.M., and 4 P.M., nor when there is danger of freezing.
- J. The CONTRACTOR shall, at his expense, maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include watering, filling, leveling and repairing of any washed or eroded areas, as may be necessary.

### 3.02 PAVEMENT REPLACEMENT

- A. Asphalt pavement shall be removed by saw cutting on a straight line with edges as vertical as possible. Concrete pavement or asphalt surfaced concrete shall be removed by cutting with a concrete saw in as straight a line and vertically as possible.
- B. Non-asphalt pavement replacement shall be replaced of like material and thickness. Asphalt or built-up asphalt pavement replacement shall be replaced with like material or concrete as directed by the ENGINEER.
  - 1. Where asphalt or built-up asphalt pavement is replaced by concrete, the concrete shall have a minimum of 6 inches in thickness and be reinforced with 6 by 6 No. 6 gage welded wire fabric. Where the pavement replacement is of like material, it shall be replaced in thickness equal to or better than that existing at the time of removal.
- C. Road cuts across City or County roads shall not be cut.
- D. Unless the base is sealed or other temporary paving applied over driveway areas to be repaved, pavement shall be replaced not later than three weeks after completion of backfill.

### 3.03 CURB REMOVAL AND REPLACEMENT

- A. Curb removal and replacement required in the construction of this work shall be done by the CONTRACTOR. Reasonable care shall be exercised in removing the curb, and the CONTRACTOR shall either stockpile or dispose of this material as directed by the ENGINEER. Curb shall be replaced of like material in a manner and condition equal to or better than that existing at the time of removal. Materials and methods of replacing State Highway sidewalks or curbs shall conform to the Department of Transportation specifications.

### 3.04 TESTS

- A. The CONTRACTOR shall furnish facilities for making all density tests and make such restorations as may be necessary due to test operations. All density tests on backfill or base replacement will be made by a commercial testing laboratory employed by the CONTRACTOR at such locations as may be recommended by the ENGINEER. If the densities as determined by the specified tests fall below the required minimums, the CONTRACTOR shall pay for all retests.

END OF SECTION 32 92 00

## **SECTION 32 92 10 – Grassing**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of grassing work is as specified or shown on the construction plans. All other areas disturbed during construction operations shall be seeded.

#### **1.03 QUALITY ASSURANCE**

- A. All seed used shall be labeled in accordance with U. S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of invitation for bids. All seed shall be furnished in sealed standard containers, unless exception is granted in writing by Owner. Seed which has become wet, moldy, or otherwise damaged in transit or in storage shall not be used. Fertilizer shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged, making it unsuitable for use, shall not be used. Seed, fertilizer and other grassing materials shall be stored under cover and protected from damage which would make them unacceptable for use.

#### **1.04 SUBMITTALS**

- A. Approvals, except those required for field installations, field applications, and field tests shall be obtained before delivery of materials or equipment to the project. The results of laboratory tests performed on the topsoil material shall be submitted. The reports shall include the pH level, the amount of organic matter, and available phosphoric acid and potash of the soil intended for use in the work. Certificate of conformance will be required for the following:
  - 1. Grass seed shall be certified by registered, certified seed association or a registered testing laboratory not more than ten months prior to seeding
  - 2. Sprigs
  - 3. Fertilizer
  - 4. Topsoil
  - 5. Lime
  - 6. Mulching

### **PART 2 - PRODUCTS**

#### **2.01 TOPSOIL**

- A. If the quantity of existing stored or excavated topsoil is inadequate for planting, sufficient additional topsoil shall be furnished. Topsoil furnished shall be a natural, fertile, friable soil,

possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well-drained areas. Topsoil shall be without admixture of subsoil and free from johnson grass (*Sorghum halepense*), nut grass (*Cyperus rotundus*) and objectionable weeds and toxic substances.

2.02 SOIL ADMENDMENTS

- A. Lime: Ground Limestone (Dolomite) containing not less than 85 percent of total carbonates, and shall be ground to such a fineness that 50 percent will pass a 100-mesh sieve and 90 percent will pass a 20-mesh sieve.
- B. Fertilizer: 16-16-16 formulation of which 60 percent of the nitrogen is in the urea-formaldehyde form and shall conform to the applicable State Fertilizer laws. It shall be granulated so that 80 percent is held on a 16-mesh screen, uniform in composition, dry and free-flowing.
- C. Mulch: Clean hay or fresh straw:

2.03 GRASS MATERIALS

- A. Grass Seed: Federal Specifications JJJ-S-181 and shall satisfy the following requirements:

Seed	Min. % Pure Seed	Min % Germination and Hard Seed	Max % Weed Seed
Bermuda Grass, (Cynodon Dactylan)	80%	15%	0.25%

- B. Seed failing to meet the purity or germination requirements by no more than twenty-five percent may be used, but the quantity shall be increased to yield the required rate of pure live seed. Seed failing to meet the weed seed requirements shall not be used.

PART 3 - EXECUTION

3.01 GRADING

- A. Areas to be grassed shall be graded to remove depressions, undulations, and irregularities in the surface before grassing.

3.02 PLACING TOP SOIL

- A. Areas to be grassed shall have a minimum topsoil cover of two inches. Topsoil shall not be placed when the subgrade is excessively wet, extremely dry or in a condition otherwise detrimental to the proposed planting or proper grading.

3.03 TILLAGE

- A. The area to be grassed shall be thoroughly tilled to a depth of four inches using a plow and disc harrow or rotary tilling machinery until a suitable bed has been prepared and no clods or clumps remain larger than 1-1/2 inches in diameter.

3.04 APPLICATION TIME

- A. The pH of the soil shall be determined. If the pH is below 5.0, sufficient lime shall be added to provide a pH between 5.5 and 6.5. The lime shall be thoroughly incorporated into the top three to four inches of the soil. Lime and fertilizer may be applied in one operation.

3.05 APPLICATION OF FERTILIZER

- A. Fertilizer shall be applied at the rate of 6 pounds per 1,000 square feet and shall be thoroughly incorporated into the top three to four inches of soil.

3.06 PLANTING SOIL.

- A. All areas disturbed during construction shall be seeded as specified herein. Immediately before seeds are sown and after fertilizer and lime are applied, the ground shall be scarified as necessary and shall be raked until the surface is smooth, friable, and of uniformly fine texture. Areas to be grassed shall be seeded evenly with a mechanical spreader, raked lightly, rolled with a 200-pound roller, and watered with a fine spray.

- 1. Seed shall be applied at the following rate

<u>Seed</u>	<u>Rate of Application</u>
Argentine Bahia Grass (Paspalum notatum)	6 lbs./1000 sq. ft. 260 lbs./acre
Bermuda Grass, (Cynodon Dactylan)	6 lbs./1000 sq. ft. 260 lbs./acre

- 2. Seeded areas shall be mulched at the rate of not less than 1-1/2" loose measurement over all seeded areas. Spread by hand, blower, or other suitable equipment. Mulch shall be cut into the soil with equipment capable of cutting the mulch uniformly into the soil. Mulching shall be done within 24 hours of the time seeding is completed. All seeded areas shall be mulched, no exceptions. Hydro-see must also be mulched.

3.07 ROLLING

- A. After seeding and mulching, a cultipacker, traffic roller, or other suitable equipment shall be used for rolling the grassed areas. Areas shall then be watered with a fine spray.

3.08 WINTER COVER

- A. All areas to be grassed shall be protected against erosion at all times. For protection during winter months (November 1st through March 31st) Italian rye grass shall be planted at the rate of four pounds per 1,000 square feet on all areas which are not protected by permanent grass. This does not alleviate the contractor from the required seeding.

3.09 CLEAN-UP

- A. All excess soil, excess grass materials, stones, and other waste shall be removed from the site daily and not allowed to accumulate.

3.010 MAINTENANCE

- A. Maintenance shall begin immediately following the last operation of grassing and continue until final acceptance. Maintenance shall include watering, mowing, replanting, and all other work necessary to produce a uniform stand of grass. Grassing will be considered for final acceptance when the permanent grass is healthy and growing on 97 percent of the area with no bare areas wider than 12 inches.

### 3.011 ACCEPTANCE

- A. The Contractor shall submit to the Owner two copies of a written request for final acceptance of the grassing work. The request shall be submitted at least ten days prior to the anticipated date of acceptance. The condition of the grass will be noted, the Contractor will be notified if maintenance is to continue.

**END OF SECTION 32 92 10**

**SECTION 32 92 11 - SODDING**

**PART 1 - GENERAL**

1.01 WORK INCLUDED

- A. Sod Installation

1.02 REFERENCES

- A. ASPA - American Sod Producers Association - Guideline Specifications to Sodding.
- B. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.03 DEFINITIONS

- A. Weeds: Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Hill, Bindweed, Bent Grass, Wild Garlic, Perrenial Sorrel, and Brome Grass.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sod on pallets. Protect exposed roots from dehydration.
- B. Do not deliver more sod that can be laid within 24 hours.

**PART 2 - PRODUCTS**

2.01 ACCEPTABLE SOD GROWERS

- A. Nurseries and Sod Growers in the surrounding area who have a 5-year record are acceptable.

2.02 MATERIALS

- A. Sod:
  - 1. ASPA approved, field grown grade; cultivated grass sod; for low maintenance and traffic durability, with strong fibrous root system, free of stone, burned or bare spots; containing no more than 5 weeds per 1000 square feet.
- B. Approved Sods:
  - 1. Bermuda, (Cynodon Dactylon).

2.03 HARVESTING SOD

- A. Machine cut sod and load on pallets in accordance with ASPA guidelines.
- B. Cut sod in area not exceeding one square yard, with minimum 1/2 inch and maximum one inch topsoil base.

### **PART 3 - EXECUTION**

#### **3.01 INSPECTION**

- A. Verify that prepared soil base is ready to receive the work of this Section.
- B. Beginning of installation means acceptance of existing site conditions.

#### **3.02 PREPARATION OF SUBSOIL**

- A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded. Remove contaminated subsoil.

#### **3.03 LAYING SOD**

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod immediately on delivery to site and within 24 hours after harvesting to prevent deterioration.
- C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12-inches overlapping; minimum. Do not stretch or overlap sod pieces.
- D. Lay smooth. Align with adjoining grass areas. Place top elevation of sod 1/2 inch below adjoining paving or curbs.
- E. On slopes 6 inches per foot and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.
- F. Prior to placing sod, on slopes exceeding 8 inches per foot or where indicated, place wire mesh over topsoil. Securely anchor in place with wood pegs sunk firmly into the ground. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.
- G. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.
- H. Sod shall be laid in all ditch areas and slopes that are equal to or steeper than 1 vertical to 3 horizontal or in areas determined by the Engineer to "erosion problem" areas. Sod shall be pinned down for stabilization in these areas.

END OF SECTION 32 92 11



## **SECTION 33 11 16 - WATER DISTRIBUTION SYSTEM**

### **16.1 INTENT**

It is the intent of these specifications to provide supplemental information 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 imaged or real, shall be brought to the attention of the Owner's Engineer for clarification.

### **16.2 DESCRIPTION OF WORK**

Extent of work is shown on the drawings.

Domestic water system work includes but is not limited to: Water mains, fire hydrants, valves, service laterals, appurtenances.

Comply with the requirements of applicable Division 2 sections for excavation and backfilling required in connection with water distribution system work.

Comply with requirements of applicable Division 2 sections for concrete work required in connection with water distribution system work.

### **16.3 QUALITY ASSURANCE**

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).

Testing and Inspection Service: Employ, at Contractor's expense, testing laboratory to perform bacteriological testing of water mains.

It will be the responsibility of the Contractor to coordinate all testing and inspections. The Contractor shall notify the Owner's Engineer, testing service, and applicable agency inspectors 48 hours in advance of testing and inspections.

### **16.4 SUBMITTALS**

Prior to construction commencement, the Contractor shall submit for approval by the Owner's Engineer manufacturer's certifications and cut sheets for the following items: fire hydrant assemblies, valves, water main pipe, fittings, water services, tapping sleeves, appurtenances.

Test Reports: Submit the following applicable reports directly to the Engineer from the testing services with copy to Contractor: Bacteriological Test Reports.

### **16.5 PRODUCTS**

General: All materials shall be accordance with the Material Standard and shall, in no event, be less than that necessary to conform to the requirements of any applicable law, ordinances, and codes.

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 Owner's Engineer, are inferior or of a lower grade than indicated, specified, or required will not be accepted.

## 16.6 WATER MAINS

General: Water main pipe shall be as shown on the drawings.

## 16.7 DUCTILE IRON PIPE - PUSH ON JOINTS

Pipe: Pipe shall be of ductile iron and manufactured in accordance with AWWA Standard C-150, in nominal 18 or 20 foot laying lengths having minimum metal physicals of 60-42-10. Minimum pipe wall thickness class shall be Thickness Class 51 for pipe six inches and larger and Thickness Class 51 for three inch or four inch pipe.

Joints: Joints for ductile iron pipe shall be of the push-on type; "Super Bell Tite", Tyton", and "Fastite" joints are acceptable. All joints shall be in accordance with AWWA Standard C-111, and all joint accessories shall be furnished with all pipe.

Coating: All pipe furnished shall be cement mortar lined and seal coated in accordance with AWWA Standard C-104. The lining thickness shall be "standard" thickness.

## 16.8 DUCTILE IRON PIPE - MECHANICAL JOINTS

Pipe: All pipe shall be of ductile iron and manufactured in accordance with AWWA Standard C-150/A21.51, in nominal 18 or 20 foot laying lengths having minimum metal physicals of 60-42-10. Minimum pipe wall thickness class shall be Thickness Class 51 for six inch pipe and larger and Thickness Class 51 for three inch and four inch.

Joints: Joints shall be mechanical joints in accordance with AWWA Standard C-111, with exceptions noted herein. All joint accessories shall be furnished with the pipe. Mechanical joint bolts and nuts shall be manufactured of high-strength, low-alloy steel such as "Corten", "Usalloy", or "Acipalloy".

The gasket shall be for a standard mechanical joint, of BUNA-S (SBR Buna) in accordance with ANSI A21.4, AWWA C-104. The follower gland shall be manufactured from ductile iron (at least ASTM A536, Grade 70-50-05) in accordance with ANSI, A21.11, AWWA C-111, where applicable.

Coating: All fittings furnished shall be cement mortar lined and coated in accordance with AWWA Standard C-104, latest revision. The lining thickness shall be "standard" thickness.

## 16.9 POLYVINYL CHLORIDE (PVC) PIPE - 4" THROUGH 12"

Pipe: PVC pipe shall be manufactured in accordance with AWWA Standard C900, latest edition. All PVC pipe shall be pressure class 200 and must meet dimension requirements of dimension ratio (DR) 18 for four inch through twelve inch pipe.

All PVC pipe shall be marked using a solid No. 10 copper wire buried between 3 and 6 inches above the top of the pipe. Backfill shall be carefully placed to a depth of 3 inches by hand to assure that the wire is secured in place over the pipe. It is the intent of the paragraph to provide a means to locate PVC pipe using standard pipe location equipment. The wire shall be carried up through valve boxes and terminated at least 2 feet above the ground line to permit connecting of location equipment. Excess wire at valve boxes shall be neatly rolled and stored in the valve box for easy accessibility. Number 10 locating wire splice shall be heat sealed or water proof splicing connector.

Joints: Joints shall be "push-on" and shall meet all requirements of ASTM Standard D-3139. 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 Standard F-477. Push-on joints and pipe shall be equal to Supermain 900 water main as manufactured by Clow Corporation.

#### 16.10 POLYVINYL CHLORIDE (PVC) PIPE - SMALLER THAN 4"

Pipe: All PVC pipe less than four inches in diameter shall be manufactured in accordance with ASTM D-2241, with a standard dimension ratio (SDR) of SDR 26, rated pressure 200 psi, and bear the National Sanitation Foundation Seal for potable water pipe.

All PVC pipe shall be marked using a solid No. 10 copper wire buried between 3 and 6 inches above the top of the pipe. Backfill shall be carefully placed to a depth of 3 inches by hand to assure that the wire is secured in place over the pipe. It is the intent of the paragraph to provide a means to locate PVC pipe using standard pipe location equipment. The wire shall be carried up through valve boxes and terminated at least 2 feet above the ground line to permit connecting of location equipment. Excess wire at valve boxes shall be neatly rolled and stored in the valve box for easy accessibility. Number 10 locating wire splice shall be heat sealed or water proof splicing connector.

Joints: Joints shall be "push-on" and shall meet all requirements of ASTM Standard D-3139. 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 Standard F-477.

Pipe Marking: All pipe shall be marked as prescribed in ASTM 3-2241, i.e., 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.

#### 16.11 FITTINGS

General: Fittings three inches and larger shall be ductile iron manufactured in accordance with AWWA Standard C-110/A21.10 or C-153/A21.53. The minimum pressure rating for fittings shall be 250 psi.

Coating: All fittings furnished shall be cement mortar lined and coated in accordance with AWWA Standard C-104.

Anchoring Devices: All anchoring devices shall be suitable for use with mechanical joint fittings meeting ANSI/AWWA Standards C-110, and/or C-111.

All anchoring devices shall be constructed of ductile iron (at least ASTM A536 Grade 70-50-05) and manufactured in accordance with ANSI/AWWA C-110 and/or C-111.

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.

Retainer Glands: 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. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. 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/AWWA A21.11 and ANSI/AWWA C153/A21.53 of latest revision. Twist-off nuts shall be used to insure proper actuating of the restraining devices.

The mechanical joint restraining device shall have a working pressure of at least 350 psi with a minimum safety factor of 2:1 and shall be EBAA Iron, Inc., MEGALUG or equal.

Push-on joint restraints shall be similar to EBAA iron, series 800 or approved equal.

Coatings: Coatings shall be as follows:

Flange adapters shall be provided with a painted "shop coat".

Retainer glands shall be provided with a bituminous coat.

Push-on restraints shall be provided with a bituminous coat.

#### 16.12 PRECAST THRUST BLOCKS

General: Precast concrete thrust blocks shall be manufactured to provide the minimum dimensions and construction shown on the plans. Precast thrust blocks will be subject to approval by the Owner's Engineer.

Concrete: Refer to applicable Division 2 specification.

#### 16.13 GATE AND TAPPING VALVES

General: Gate and tapping valves shall be resilient seat and shall comply with all requirements of AWWA Standard C-509 and the following supplemental requirements:

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.

All valves shall be Class B gray iron body, non-rising stem, water valves suitable for buried vertical mounting.

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.

Stem nuts shall be independent of wedge and shall be of solid bronze conforming to ASTM B-62.

Sealing mechanism shall be either a replaceable, internally-reinforced, specially-contoured, molded rubber disc 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 D-429. Replaceable seat rings shall be designed such that it cannot be installed improperly.

Stuffing boxes shall be O-ring seal type with two rings located in the stem.

Low friction torque reduction thrust bearings shall be located both above and below the stem collar.

All valves shall open by turning a two-inch square AWWA operating nut counterclockwise.

Joints: Joints shall be mechanical joints and shall conform to AWWA Standard C-111, and all bolts and nuts for mechanical joints shall be high-strength, low-alloy steel in accordance with Section 11-6.5 of AWWA C-111. All gaskets shall be for a standard mechanical joint of BUNA-S (SBR Buna) in accordance with ANSI A21.4 and AWWA C-111. All mechanical joint accessories shall be furnished with the valves.

All valves shall be furnished with operating nuts and two (2) operating wrenches.

All tapping valves shall have flange by mechanical joint ends.

All tapping valves shall be interchangeable with other makes of tapping sleeves.

Coating: Body and cover bolts and nuts shall meet specifications ASTM A-307 and be rust proof. Valve interior shall have protective coating meeting AWWA Standard C-550.

#### 16.14 BUTTERFLY VALVES

General: All butterfly valves and operators shall meet all requirements of AWWA Standard C-504, for Class 150B, buried service valves and the following criteria:

Mechanical joint valve ends shall be in accordance with AWWA C-111.

Accessories (bolts, gaskets, etc.) shall be supplied by the valve manufacturer, and the joint bolts and nuts shall be a high-strength, low-alloy such as "Corten", "Usalloy", "Acipalloy" or approved equal.

Valve Seat: The valve seat shall be located on the valve body or disc and shall provide drip-tight shutoff for pressure differential of 150 psi versus 0 psi in either direction. The seat shall be of Buna N rubber and shall be clamped, mechanically secured, bonded, or vulcanized to the valve body or disc.

Valve Shafts and Disc: The valve shaft shall be a one-piece unit extending completely through the valve disc or may be stub shaft construction. Shaft materials shall conform to AWWA Standard C-504, Section 3.3. No deviation will be accepted. The valve disc shall have no external ribs transverse to the flow and shall be constructed of material as specified in AWWA C-504, Section 3.4, latest revision. No deviation will be accepted.

Valve Shaft Seals: Shaft seals shall be standard "O" ring or "V" packing seals, and all seals shall be replaceable without disassembly of the valve.

Operators: The operator shall be manual type opening to the right and equipped with two inch AWWA operating nut. The operator shall be gear type or traveling nut type. All operators shall be totally enclosed, sealed, gasketed, and lubricated for underground service. The operator shall also be able to output torque required to operate the valve under adverse conditions without exceeding input torque as allowed under AWWA Standard C-504. It shall also be capable of withstanding overload input torque as specified in AWWA Standard C-504, latest revision.

#### 16.15 TAPPING SLEEVES

General: Tapping sleeves shall be constructed of heavy gray cast iron, ductile cast iron, or high-strength steel and in two halves. All tapping sleeves shall be suitable for Class C and D gray cast iron, ductile cast iron pipe, and all pipe manufactured in accordance with ANSI S 21 standards.

Joints: Tapping sleeves shall seal to the pipe by the use of a confined "O" ring gasket and able to withstand a pressure test of 150 psi with no leakage in accordance with AWWA C-110. A 3/4 inch NPT test plug shall be provided for pressure testing. All bolts joining the two halves shall be high-strength, low-alloy steel in accordance with Section 11-6.5 of AWWA C-111, and shall be included with the sleeve.

The outlet branch flange shall be a 125# flange joint suitable for attachment by all other makes of tapping valves meeting AWWA standards.

Coatings: All gray cast iron and ductile cast iron sleeves shall have an outside bituminous coating in accordance with AWWA C-110 and an inside cement-mortar lining in accordance with AWWA C-104. All steel sleeves shall be finished with an epoxy coating both inside and outside.

#### 16.16 TAPPING SADDLES

General: Tapping saddles shall be constructed of heavy gray cast iron or ductile cast iron, with the attachment straps, nuts, and washers constructed of corrosion-resistant, alloy steel in accordance with

AWWA C-111. All tapping saddles shall be suitable for Class C & D gray cast iron, ductile cast iron pipe, and all pipe manufactured in accordance with ANSI A 21 Standards.

Joints: Tapping saddles shall seal to the pipe by the use of a confined "O" ring gasket and be able to withstand a pressure test of 150 psi with no leakage in accordance with AWWA C-110. A 3/4 inch NPT test plug shall be provided for pressure testing.

The outlet branch flange shall be a 125# flange joint suitable for attachment by all other makes of tapping valves meeting AWWA standards.

Coatings: Tapping saddles shall have outside bituminous coating in accordance with AWWA C-110 and an inside cement-mortar lining in the branch run in accordance with AWWA C-104.

#### 16.17 DRY-BARREL FIRE HYDRANT

All fire hydrants shall comply fully with all provisions of AWWA C502, latest edition. Hydrants shall be the dry barrel type which prevents the operating threads from coming into contact with the service water. Hydrants shall be of the compression type, opening against the line pressure and closing with the line pressure. The hydrant shall be equipped with a weather shield to protect the operating nut. An oil or a grease reservoir and lubrication system that automatically circulates lubricant to all operating stem threads and bearing surfaces each time the hydrant is operated shall be provided. The system shall be completely sealed from the waterway by means of "O" ring seals. The hydrant shall be the traffic breakaway type with a safety stem coupling and flangible segments that permit full 360 degree rotation of the nozzle. The main valve opening of the hydrant shall not be less than 5-1/4 inches in size. Hose and steamer connection threads shall be National Standard type. The hydrant shall be designed to permit removal of all working parts from the hydrant up through the barrel of the hydrant without disturbing the earth around the hydrant or disassembling the barrel. An all bronze hydrant valve seat ring shall thread directly into an all bronze drain ring and shall be located between the lower hydrant barrel and base, securely retained in position, or it may be threaded into a heavy bronze bushing in the hydrant base. The valve seat ring and drain ring shall have no less than two bronze drain ports and two bronze drain outlets. The hydrant shall be designed with an anti-friction bearing located so that it will reduce the torque required to operate the hydrant. Both the operating nut and the nozzle cap wrench nut shall be National Standard type. All hydrants shall be shop tested in accordance with AWWA C502, latest edition. The interior of the hydrant foot shall be coated with a fusion-bonded epoxy coating of a minimum of at least six mils. Hydrant exterior shall be painted with two coats of high-visibility red enamel paint.

Approved models are American Darling B-84-B; Mueller Centurion; M&H A-129 or Clow Medallion. No substitutions will be allowed.

#### 16.18 WATER SERVICES

Service Lines: Water service shall be polyethylene Class 200 SDR9 manufactured in accordance with AWWA C-902 or cross linked polyethylene Pipe (PEXa) manufactured in accordance with AWWA C904. Contractor will terminate services five feet from building locations with a curb stop. For subdivisions a mark shall be scribed permanently in concrete curbs etc. for location of services. Water service separations between storm sewer and sanitary sewer shall be the same as for water mains.

Curb Stop: Ford style B43-444 for 1" meter valve or approved equal.

Corporation Stop: No FB 1000 (CC type) or equal.

Fittings: All fittings shall be manufactured of brass, cast with full port of full open valve and machined in accordance with AWWA Standard C-800.

The fittings shall be as manufactured by Mueller Company, Hays Manufacturing Company, Ford Meter Box Company, James Jones Company, or A.Y. McDonald Manufacturing Company, or approved equal.

Service Saddles: All service saddles shall be used for tapping water distribution pipes to provide a connection for service lines. Ford Style 202 or approved equal.

Service saddles for pipe less than three inches shall be a single band which is hinged or split from the saddle body and is anchored by bolting one or more bolts between the band and saddle body.

Service saddles for pipe greater than three inches shall vary in bolt patterns and band numbers based on the type of pipe to be tapped.

Service saddles for six inch and eight inch PVC C-900 pipe shall be a double-wide single flexible band, or two bands, sized exactly for six inch and eight inch PVC C-900 pipe and is to be anchored by a minimum four bolt pattern on the saddle body.

Service saddles for ANSI/AWWA C-150 ductile iron pipe shall be at least a single band, two bolt pattern saddle anchoring or hinged wide single strap with one bolt assembly.

All other service saddles for pipe greater than three inches shall use a double wide single flexible band, or two bands, with a minimum of a four bolt pattern anchoring. These service saddles shall provide for a variable range in diameter per nominal size of pipe.

#### 16.19 HANDLING PIPE

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 skidways in such a manner as to avoid shock. Under no circumstances shall pipe be dropped. Pipe handled on skidways 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 not be installed.

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 Owner's Engineer before installation.

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.

#### 16.20 INSTALLATION OF PIPE

General: Upon satisfactory installation of the pipe bedding, as specified in the "Excavation and Backfill for Utility Systems" 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.

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.

All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench, piece by piece, by means of derrick, 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 or dumped into the trench.

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 requirements.

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.

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.

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" thru 12"	3/4" per foot
16" thru 36"	1/2" per foot

Only after the pipe has been properly homed will it be allowed to deflect.

No pipe shall be laid in water or when the trench conditions or the weather is unsuitable for such work.

Water mains to provide a horizontal distance of (3) three feet between the water main and any vacuum-type sanitary sewer, storm sewer, stormwater force main, or pipeline conveying public-access reclaimed water and a horizontal distance of (6) six feet between the water main and any gravity or pressure-type sanitary sewer, wastewater force main, or pipeline conveying non-public-access reclaimed water.

Water mains crossing any gravity or vacuum-type sanitary sewer or storm sewer may be laid so the water main crosses (6) six inches above or (12) twelve inches below the other pipeline, and water mains crossing any pressure type sanitary sewer, stormwater, or wastewater force main, or pipeline conveying reclaimed water laid so the water main crosses only (12) twelve inches above or below the other pipeline.

All sewer lines and laterals shall be located a minimum of 36 inches below grade.

Any pipe which is disturbed or found to be defective after laying shall be taken up and re-laid or replaced.

Prior to connecting new work to existing lines or appurtenances, the Contractor shall verify location and elevation of existing connection point and notify Owner's Engineer of any conflicts or discrepancies.

Joints: 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.

In making up the push-on type joint, the gasket shall be placed in the socket with a large, round end entering first so that the groove fits over the bend in the seat. 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 brushed with a wire brush and placed in alignment with the bell of the pipe to which it is to be joined. The joint shall be made up 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.

Backhoe buckets or excavation equipment are not to be applied directly to the pipe.

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 finger-tight. Mechanical joints shall be assembled in accordance with AWWA Standards.

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>
3/4" Diameter	85 to 95 ft.-lbs.
1" Diameter	95 to 100 ft.-lbs.

If effective seal is not obtained at a maximum torque listed above, the joint shall be disassembled and reassembled after thorough cleaning.

If a joint is defective, it shall be cut out and entirely replaced or, if permission is given by the Owner's Engineer, it may be repaired by a suitable clamp.

#### 16.21 INSTALLATION OF FITTINGS, VALVES AND TAPS

Fittings: 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. Fittings 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 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, in a manner satisfactory to the Owner's Engineer 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.

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.

#### 16.22 ANCHORAGE OF BENDS, TEES, AND PLUGS

General: Adequate precautions shall be taken to prevent the separation of joints at bends, tees, and plugged ends.

Details: Details of design, construction, applications, installation, and number of joints necessary for the restraint of a given thrust shall be as shown in the Construction Details. Under no circumstances will gray iron pipe be used at restrained joints. Ductile iron pipe will be used unless otherwise specified by the Owner's Engineer.

Thrust Blocking: 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 and 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 City inspect placement.

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.

Precast thrust blocks may be used in lieu of poured-in-place blocks on eight inch and smaller water mains only. Approval by the Department must be obtained. This type of block must be manufactured in accordance with the Construction Details. The Owner's Engineer has the authority to reject any damaged block or any block considered to be of questionable quality. Placement will be in accordance with standard procedures for restraining thrust. Earth behind such blocks will be either undisturbed or compacted to a minimum of 95% AASHTO T-180.

#### 16.23 INSTALLATION OF VALVES

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's 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 Owner's Engineer 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.

Gate valves and butterfly valves shall be set and joined to new pipe in the manner heretofore specified for cleaning, laying, and joining pipe.

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 24 inches square or 24 inches in diameter and shall be centered on the valve box. All water department valve covers shall be painted safety blue as prescribed by the American Public Works Association (APWA) uniform color code for utility systems.

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-siphonage of contaminated water .

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.

#### 16.24 INSTALLATION OF TAPS BY CONTRACTOR

General: All material supplied, and drilling and tapping equipment used to make taps, will be sterilized in accordance with AWWA Standards.

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 Owner's Engineer at the Contractor's expense.

#### 16.25 INSTALLATION OF FIRE HYDRANTS

General: Hydrants shall be located in such a manner as to provide complete accessibility and to minimize the possibility of damage from vehicles or injury to pedestrians. Unless otherwise directed, the setting of any hydrant shall be described in the Construction Details.

All fire hydrants shall be thoroughly cleaned of dirt or foreign material before installation.

All hydrants shall stand plumb and shall have their pumper nozzle perpendicular to the curb. They shall conform to the established grade with nozzles at least 18 to 24 inches above the ground.

Each hydrant shall be connected to the water main with a six inch branch controlled by an independent six inch resilient wedge gate valve, hydrant shut-off valve. Line from fire hydrant to water main tee shall be Ductile Iron.

All hydrants shall be anchored by thrust blocks and/or restrained fittings as shown in the construction Details.

#### 16.26 TESTING AND INSPECTION REQUIREMENTS

It will be the responsibility of the Contractor to coordinate all testing and inspections. The Contractor shall notify the Owner's Engineer and applicable agency inspectors 48 hours in advance of testing and inspections.

#### 16.27 HYDROSTATIC TEST

Hydrostatic Test: A hydrostatic test shall be performed on all mains and fittings for a minimum of two hours at 150 psi in accordance with AWWA 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.

Gauges and Recorders: The Contractor shall, upon request of the Engineer, furnish certified test data for pressure gauges and recorders used on hydrostatic test equipment. At the option of the Engineer, 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.

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 line will be expelled before applying specified test pressure. To accomplish this, taps will be made, if necessary, at point of highest elevation and afterward tightly stopped with tapered brass plugs, all at the Contractor's expense.

After installation and filling of the line as specified, the hydrostatic test, which will be at least two hours in duration (two hour test period), shall proceed as follows:

The Contractor will pump his line to a pressure greater than 150 psi. At no time shall the test or line pressure exceed 190 psi. If required by the Owner's Engineer, pump test equipment shall be equipped with pressure relief valves pre-set to 190 psi.

Throughout the duration of the test, the Contractor is required to maintain a minimum pressure in excess of 150 psi. The Contractor is advised that, should the line pressure fall to or below 150 psi any time during the two-hour test, the test will be considered invalid and a re-test according to this procedure will be required. Therefore, he is advised to pump water into the line as the line pressure approaches 150 psi. The test will be conducted with a pressure variation of not more than 5 psi for the duration of the test.

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.

The allowable leakage, as specified below, will be defined as any volume of water required to maintain a minimum pressure in excess of 150 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

Allowable Leakage for AWWA PVC Pipe

Average Test Pressure In Line, PSI					
Nominal pipe size in.	50	100	150	200	250
	Allowable Leakage Per 1000 Ft or 50 Joints, gal/hr (L/hr)				
4	.19 (.72)	.27(1.02)	.33 (1.25)	.38 (1.44)	.43 (1.63)
6	.29 (1.10)	.41 (1.55)	.50 (1.89)	.57 (2.16)	.64 (2.42)
8	.38 (1.44)	.54 (2.04)	.66 (2.50)	.76 (2.88)	.85 (3.22)
10	.48 (1.82)	.68 (2.57)	.83 (3.14)	.96 (3.63)	1.07 (4.05)
12	.57 (2.16)	.81 (3.07)	.99 (3.75)	1.15 (4.35)	1.28 (4.84)

Leakage detection at mechanical joints shall be stopped by tightening the gland (not to exceed required torque) and leaking slip joints shall be cut out and entirely replaced, or, if permission is given by the Owner's Engineer, it may be repaired by a suitable clamp. Any cracked or defective pipes, fittings, valves, or hydrants discovered as a result of this pressure test shall be removed and replaced by the Contractor with sound material and then the test shall be repeated until satisfactory.

The Contractor is warned that pressure testing against existing "end-of-line" or blow-off 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.

16.28 DISINFECTION

Disinfection: All new water lines shall be thoroughly flushed to remove all foreign material before sterilizing. The Contractor shall sterilize the water mains in accordance with the applicable section of AWWA Specification C-651.

Bacteriological Testing: After disinfecting and final flushing and before the system is placed in service, samples shall be collected and tested by a laboratory, state certified in accordance with Chapter 403, Florida Statutes. Samples shall be collected as follows:

- Connection point to an existing system and the endpoint of the proposed addition;
- Any water lines branching off a main extension;
- Every 1,200 feet on straight run of pipe;
- Each location shall be sampled on two consecutive days with sample points and chlorine residual reading clearly indicated on the report.

If, during construction, trench water has entered the main, or if in the opinion of the Owner's Engineer or job superintendent, excessive quantities of dirt or debris have entered the main, bacteriological samples shall be taken at intervals of approximately 200 feet and shall be identified by location.

Samples shall be taken of water that has stood in the main for at least 16 hours after final flushing has been completed.

Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by "Standard Methods for the Examination of Water and Wastewater." No hose or fire hydrant shall be used in collection of samples. A corporation cock may be installed in the main with a copper tube goose neck assembly. After samples have been collected, the goose neck assembly may be removed and retained for future use.

## 16.29 MEASUREMENT AND PAYMENT

General: The contract unit price for the various items shall be compensation in full for furnishing all materials, labor, equipment, tools, and incidentals necessary for the installation of the item complete in every detail in accordance with the plans and specifications.

As part of the work of this section, the Contractor may be required to remove and relocate or stockpile for reinstallation upon completion of work certain items including, but not limited to, culverts and mailboxes.

No separate compensation will be provided for these items, compensation should be included in the unit price for item to which it most logically belongs. It shall be the responsibility of the Contractor to identify and be aware of these items by both field inspection and review of the plans.

Concrete: The contract unit price shall be compensation in full for one cubic yard of concrete used for foundations, anchors, encasement for pipe or concrete piers.

Water Pipe: The contract unit price for the various sizes and types of water pipe shall be compensation in full for one linear foot of pipe complete in place. The length of pipe installed will be measured along the centerline of the installed pipe from center of installed pipe or junctions to center of junction or various ends with no deduction in measured length for specials, fittings, or valves.

Cast Iron or Ductile Iron Fitting: The contract unit price for the various sizes and types of fittings shall be compensation in full for furnishing all materials, labor, equipment, tools and incidental necessary to install and complete one fitting with required thrust blocks. All fittings including bends, tees, crosses, slums etc., will be included under this item.

Gate Valves: The contract unit price for the various sizes and types of gate valves shall be compensation in full for furnishing all materials, labor, equipment, tools, including valve stem extension, valve box, concrete pad, and incidentals necessary to install and complete one valve.

Fire Hydrant: The contract unit price shall be compensation in full for furnishing all materials, labor, equipment, tools, and incidentals necessary to install and complete one fire hydrant, auxiliary gate valve with concrete pad and required thrust blocks.

Tapping Sleeve and Valve: The contract unit price for the various types and sizes shall be compensation in full for one valve with valve box, concrete pad, and valve stem extension, if required, and tapping sleeve, size to suit existing water pipe complete in place.

Rust Proof Rods for Anchorage: The contract unit price shall be compensation in full for furnishing all labor, materials, equipment, tools, and incidentals necessary to install one linear foot of anchor rod. The price shall include threading, bolts, and coating of the rod.

Removing and Replacing Paving: The contract unit price for this item will be compensation in full for furnishing all materials, labor, equipment, and incidentals to remove and replace one square yard of paving under which pipe is laid. The term "Pavement" shall be construed to mean either concrete, bituminous, cobblestones, or brick placed as a wearing surface in streets, driveways, or sidewalks; or

placed as slope protection for ditches or drains. Shell surfacing, sand-clay surfacing, gravel surfacing, and other such types of surfacing will not be considered paving and will not be paid for as such. In measuring this item for payment, the length removed multiplied by a width of the inside pipe diameter plus 30 inches will be the amount paid for, or were shown as limits of payment for pavement repair on construction plans, regardless of the width removed and replaced. No additional allowance will be made for bell holes or manholes. Where flexible pavement is replaced, no additional allowance will be made for base course or asphalt tack coat.

Encasement Pipe: The contract unit price for furnishing and installing encasement pipe shall be compensation in full for furnishing all material, labor, skids, equipment, and incidentals necessary to install and complete one linear foot of the encasement pipe of various sizes and types in accordance with the plans and specifications. Measurement will be made along the centerline of the installed encasement pipe. The carrier pipe inside encasement pipe will not be included in the contract unit price for encasement pipe.

**END OF SECTION 33 11 16**

## SECTION 33 51 01 - VALVES AND ACCESSORIES

### PART 1 - GENERAL

#### 1.01 SCOPE OF WORK

The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required and install complete and ready for operation and test all buried and non-buried valves as shown on the Drawings and as specified herein.

#### 1.02 SUBMITTALS

- A. Submit materials required to establish compliance with these Specifications in accordance with Section 01300. Submittals shall include the following:
  - 1. Certified drawings showing all important details of construction and dimensions.
  - 2. Descriptive literature, bulletins and/or catalogs of the equipment.
  - 3. The total weight of each item.
  - 4. A complete bill of materials.
  - 5. Additional submittal data, where noted with individual pieces of equipment.
- B. Test Reports: Provide certified hydrostatic test data, per Manufacturers standard procedure or MSS-SP-61 for all valves.
- C. Certificates: For each valve specified to be manufactured, tested and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.
- D. Manufacturer's Installation and Application Data
- E. Operating and Maintenance Data: Operating and maintenance instructions shall be furnished to the ENGINEER. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions and other information required to instruct operating and maintenance personnel unfamiliar with such equipment.

#### 1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A48 - Specification for Gray Iron Castings.
  - 2. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  - 3. ASTM A159 - Specification for Automotive Gray Iron Castings.

4. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
  5. ASTM A276 - Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
  6. ASTM A436 - Specification for Austenitic Gray Iron Castings.
  7. ASTM A536 - Specification for Ductile Iron Castings.
  8. ASTM B30 - Specification for Copper-Base Alloys in Ingot Form.
  9. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings
- B. American Water Works Association (AWWA):
1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
  2. AWWA C500 - Gate Valves, 3-in Through 48-in NPS, for Water and Sewage Systems
  3. AWWA C504 - Rubber-Seated Butterfly Valves
  4. AWWA C507 - Ball Valves 6-in Through 48-in
  5. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-in Through 24-in NPS
  6. AWWA C509 - Resilient-Seated Gate Valves, 3-in Through 12-in NPS, for Water and Sewage Systems
  7. AWWA C511 - Reduced Pressure Principle Backflow Prevention Assembly
  8. AWWA C540 - Power-Actuating Devices for Valves and Sluice Gates
  9. AWWA C550 - Protective Interior Coatings for Valves and Hydrants
  10. AWWA C800 - Underground Service Line Valves and Fittings
  11. AWWA C515 – Resilient Seated Valves for 14” and Larger
- C. American National Standards Institute (ANSI):
1. ANSI B2.1 - Specifications, Dimensions, Gauging for Taper and Straight Pipe Threads (except dry seals).
  2. ANSI B16.1 - Cast Iron Pipe Flange and Flanged Fittings Class 25, 125, 250 and 800
  3. ANSI B16.10 - Face-to-Face and End-to-End Dimensions of Valves
  4. ANSI B16.104 - Butterfly Valves



- D. American Iron and Steel Institute (AISI).
- E. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS):
  - 1. MSS-SP-61 - Pressure Testing of Steel Valves.
  - 2. MSS-SP-67 - Butterfly Valves.
  - 3. MSS-SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
  - 4. MSS-SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  - 5. MSS-SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Services.
  - 6. MSS-SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
  - 7. MSS-SP-80 - Bronze Gate, Globe, Angle and Check Valves.
  - 8. MSS-SP-82 - Valve Pressure Testing Methods
  - 9. MSS-SP-98 - Protective Epoxy Coatings for Interior of Valves and Hydrants.
- F. National Electrical Manufacturers Association (NEMA).
- G. Underwriters Laboratories (UL).
- H. Factory Mutual Insurance (FM).
- I. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

#### 1.04 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Valves and appurtenances shall be products of well established firms who are fully experienced, minimum 10 years, reputable and qualified in the manufacture of the particular equipment to be furnished.
  - 2. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.
  - 3. All units of the same type shall be the product of one Manufacturer.
- B. Certifications:
  - 1. The Manufacturer's shall furnish an affidavit of compliance with Standards referred to herein as specified in paragraph 1.03C.
  - 2. Refer to Part 3 for testing required for certain items in addition to that required by referenced standards.
- C. Provide the services of a qualified and factory-trained service representative of the

Manufacturer to provide operational and maintenance instruction, for a one-day, eight hour period for:

1. Valve motor operators.
  2. Valve hydraulic operators.
  3. Valve pneumatic operators.
  4. Pressure regulating valves.
  5. Air release, air and vacuum valves.
- D. Inspection of the units may also be made by the ENGINEER or other representative of the OWNER after delivery. The equipment shall be subject to rejection at any due to failure to meet any of the Specification requirements, even though submittal data may have been accepted previously. Equipment rejected after delivery shall be marked for identification and shall be removed from the job site at once.

#### 1.05 SYSTEM DESCRIPTION

- A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of wastewater, sludges, reclaimed water, potable water, air or chemicals, depending on the individual systems, as noted on the Drawings.
- B. Valves, appurtenances and miscellaneous items shall be installed as shown on the Drawings and as specified, so as to form complete workable systems.
- C. Unless otherwise noted all powered valve operators shall have:
1. Valves smaller than 8 inches: electric operators 120V, single phase, 60 Hz.
  2. Valves larger than 8 inches: electric operators 480 volt, 3 phase, 60 Hz.
  3. Solenoid valves: 120 volt, single phase, 60 hz, NEMA 4 enclosure, continuous duty Class F coils and manual operator.
  4. See other paragraphs for additional requirements.
- D. Packing and Shipping:
1. Care shall be taken in loading, transporting and unloading to prevent injury to the valves, appurtenances, or coatings. Equipment shall not be dropped. All valves and appurtenances shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to the coatings shall be repaired as acceptable to the ENGINEER.
  2. Prior to shipping, the ends of all valves shall be acceptably covered to prevent entry of foreign material. Covers shall remain in place until after installation and connecting piping is completed.
    - a. All valves 3-in and larger shall be shipped and stored on site until time of use with wood or plywood covers on each valve end.
    - b. Valves smaller than 3-in shall be shipped and stored as above except

that heavy cardboard covers may be used on the openings.

- c. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until the valve is installed and put into use.
- d. Any corrosion in evidence at the time of acceptance by the OWNER shall be removed, or the valve shall be removed and replaced.

E. Storage and Protection:

Special care shall be taken to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, to prevent deformation. See the individual piping specifications and Manufacturer's information for further requirements.

1.06 MAINTENANCE

- A. Special tools and the Manufacturer's standard spare parts, if required for normal operation and maintenance, shall be supplied with equipment.
- B. Provide all special tools required for normal maintenance.
- C. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.
- D. Provide to the OWNER a list of all spare and replacement parts with individual prices and location where they are available.
- E. Prices shall remain in effect for a period of not less than one year after start-up and final acceptance.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT - GENERAL

- A. Reference is made to Division 1 for additional requirements, including nameplates, provisions for temporary pressure gages, protection against electrolysis and anchor bolts.
- B. The use of a Manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- C. Valves and appurtenances shall be of the size shown on the Drawings or as noted and as far as possible equipment of the same type shall be identical and from one Manufacturer.
- D. Valves and appurtenances shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed and standard referenced, cast in raised letters or indelibly marked upon some appropriate part of the body.
- E. Unless otherwise noted, items shall have a minimum working pressure of 150 psi or be of the same working pressure as the pipe they connect to, whichever is higher and suitable for the pressures noted where they are installed.

- F. Joints, size and material - unless otherwise noted or required by the ENGINEER:
  - 1. Except where noted, all joints referred to herein shall be of the same type, nominal diameter, material and with a minimum rating equal to the pipe or fittings they are connected to.
  - 2. Valves and appurtenances shall be of the same nominal diameter as the pipe or fittings they are connected to.
  - 3. All valves exposed to view, or in vaults.
    - a. 3-in and smaller - threaded ends
    - b. 4-in and larger flanged ends.
- G. Provide all special adaptors as required to ensure compatibility between valves, appurtenances and adjacent pipe.
- H. Valves and actuators located outdoors but not within a building; within maximum 2-ft above liquid; in vaults; or where otherwise noted shall be especially designed for submerged service where water may completely submerge the valve and operator. All other units shall be as a minimum weather tight.

## 2.02 VALVE ACTUATORS - GENERAL

- A. The valve Manufacturer shall supply and integrally, rigidly mount all actuators, including any type of manual or powered actuators, on valves at the factory. The valves and their individual actuators shall be shipped as a unit.
- B. Unless otherwise noted, valves shall be manually actuated; nonburied valves shall have an operating wheel, handle or lever mounted on the operator; buried valves and those with operating nuts shall have a non-rising stem with an AWWA 2-in nut. At least two tee handles shall be provided for all operating nuts.
- C. Except as otherwise shown on the Drawings or specified herein, all valves 3-in diameter or larger, with the valve center line located 7-ft or more above the operating floor, shall be provided with chain wheel operators complete with chain guides and hot dipped galvanized steel chain, which loop within 4-ft of the operating floor.
- D. All actuators shall be capable of moving the valve from the full open to full close position and in reverse and holding the valve at any position part way between full open or closed.
- E. Each operating device shall have cast on it the word "OPEN" and an arrow indicating the direction of operation.
- F. Floor boxes for operating nuts recessed in concrete shall be standard cast iron type, cast-in-place, with fastening top by Clow or equal.
- G. Stem guides shall be of the adjustable wall bracket type, bronze bushed, with maximum spacing of 10-ft as manufactured by Clow; Rodney Hunt or equal. Extended operating nuts and/or stems shall have universal joints and pin couplings, if longer than 10-ft and a rating of at least five times the maximum operating torque. Stem adaptors shall be provided.
- H. Where required by the installation, or as specified, provide the following: extended stem;

floor stand and handwheel; position indicator and etched or cast arrow to show direction of rotation to open the valve; resilient seal around stem penetration of slab.

## 2.03 BUTTERFLY VALVES FOR FLUID SERVICE (METAL BODY)

- A. Butterfly valves and operators up to 72 inches diameter shall conform to AWWA C504, Class 150B, except as hereinafter specified. The Manufacturer shall submit an affidavit of compliance stating that the valves have been manufactured and tested in accordance with AWWA C504 and specifically listing all exceptions. Valves shall have a minimum 150 psi pressure rating or higher as noted on the Drawings or in the Specifications and be manufactured by Val-Matic Pratt, Dezurik or equal.
- B. Butterfly valves for above grade shall be flanged end with face to face dimensions in accordance with Table 2 of AWWA C504 Standard for short-body valve. All valves for dead end shut off service shall be flanged type. Butterfly valves for buried service shall be mechanical joint ends conforming to ANSI/AWWA C111/A21.11 and shall be mechanically restrained with Megalug Series 1100 or ENGINEER approved equal.
- C. Valve seats shall be full resilient seats retained in the body or on the disc edge in accordance with AWWA C504. Valve discs shall be constructed of cast iron, ASTM A48, Class 40; Ni-resist, ASTM A126, Class B; or ductile iron, ASTM A536, Grade 65-45-12.
  - 1. For valves 24-inch in diameter and larger, when the resilient seats are attached to the body, discs shall have Type 316 stainless steel seating edges. When the resilient seat is attached to the disc, it shall be fastened with a one piece Type 316 stainless steel retaining ring, Type 316 stainless steel Nylock set screws and a mating Type 316 stainless steel ring shall be installed in the valve body.
  - 2. Resilient seats shall be Hycar or equal. Seats shall be fully adjustable and replaceable with the valves in place for all valves.
- D. The valve body shall be constructed of close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Permanently self-lubricating body bushings shall be provided and shall be sized to withstand bearing loads. Stuffing box of liberal dimensions shall be provided at the operator end of the vane shaft.
  - 1. Packing shall be of the self compensating v-type. A sealing element utilizing O-rings shall also be acceptable for up to and including 24-in valves. Over 24-in, pull down seals using a square braid of graphited asbestos is an acceptable alternate.
  - 2. Packing shall be held in place by a bolted corrosion resistant retainer plate or gland; retainer clips are not acceptable. For 30-in or larger, use a stuffing box with follower gland.
  - 3. Replacement of seals, for all size butterfly valves, shall not require removal of the valve from the line. In addition adjustment or replacement of seals on valves of 30-in or larger shall not require disturbing any part of the valve or operator assembly, except any packing follower gland.
- E. The valve shaft shall be of Type 316 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. No reductions of shaft diameter will be allowed except at the operator connection. Any reduction shall have a full radius fillet.

- F. In general, the butterfly valve actuator shall conform to the requirements of AWWA C504, insofar as applicable and as herein specified.
- G. Gearing for the actuators where required shall be totally enclosed in a gear case in accordance with AWWA C504.
- H. The manual actuators shall conform to AWWA C504, insofar as applicable. Actuators shall have permanent indicators with raised or engraved marks to show position of the valve disc.

2.04 GATE VALVES (2-1/2-IN AND SMALLER)

- A. Gate valves 2-1/2-in diameter and smaller shall have flanged, screwed, or solder ends as required and shall be brass, or bronze, or Type 304 stainless steel solid wedge, union bonnet, rising-stem gate valves such as Figures 47 and 48 as manufactured by Jenkins Brothers or equal products as manufactured by Crane; Fairbanks; Lukenhiemer or equal.
- B. All water valves 2-1/2-in and 3-in unless noted otherwise, shall be brass body gates and shall be Jenkins No. 1240, or Hammond 1B-647.

2.05 GATE VALVES (3-IN AND LARGER)

- A. General Requirements:
  - 1. Unless otherwise specified below, these requirements shall apply to all gate valves.
  - 2. Gate valves shall meet the requirements of AWWA C500 and AWWA C509 as applicable to the type of valve specified.
  - 3. Buried and submerged valves shall be furnished with mechanical joints and stainless steel hardware; non-rising stem design.
  - 4. Exposed valves shall be furnished with Class 125 flanged ends and hand wheel; provide valves with outside screw and yoke.
  - 5. All-metal valves shall be manufactured of ASTM A536, Ductile Iron, with bronze mounting design.
  - 6. Rising stem valves shall be sealed with adjustable and replaceable packing; valve design must permit packing replacement under operating system pressures with only moderate leakage.
  - 7. Non-rising stem valves shall use a double O-ring stem seal, except that packing shall be used where geared operators are required.
  - 8. Except as otherwise specified, valves shall be rated for the following working water pressures:

<u>Valve Size</u>	<u>Pressure (psig)</u>
3-in to 12-in	250
14-in to 20-in	250
24-in and greater	250

All valve bodies shall be hydrostatically tested to at least twice the rated working water pressure. In addition, valves shall be seat-tested, bi-directional at the rated working pressure, with seat leakage not to exceed one fluid ounce per inch of valve diameter per hour. Provide certificates of testing.

9. Flanged valves to have face-to-face dimensions per ANSI B16.1 and flanges per ANAI B16.10.
10. Exposed valves 16-in and larger to have valve by-pass.
11. All bonnet and packing gland bolts shall be zinc or cadmium electroplated steel; packing gland bolts shall have bronze nuts.
12. Exposed valves 16-in and greater indicated for horizontal stem installation shall be furnished with rollers, tracks and scrapers and enclosed bevel gear grease case.
13. Provide geared operator and chain wheel, chain and chain guides for valves with handwheel centerline more than 7-ft above operating level.
14. All valves shall be marked per AWWA Standards, including name of Manufacturer, valve size and working pressure and year of manufacture.
15. Unless otherwise indicated, valves 12-in and smaller shall be capable of installation in the vertical or horizontal position, sealing in both directions at the rated pressure.
16. Valve operation shall be counterclockwise for potable water; clockwise for wastewater and other non-potable waters. Provide permanent label showing "OPEN" and arrows.
17. Metal-seated valves shall be coated internally and externally with an asphaltic varnish, per AWWA C500. Resilient seated valves shall be coated, interior and exterior, with fusion bonded epoxy per AWWA C550.

B. Valve Applications:

1. Valves for Non-Potable Water Service:
  - a. Resilient seat gate valves shall be ductile iron bodied, bronze mounted, with wedge type disk, hand wheel and rubber seat. Valves shall be manufactured in accordance with AWWA C509. Valves shall be suitable for above ground service, be designed for 150 psi working pressure, shall be of O-ring type, with non-rising stem, and opening counterclockwise. Valves shall have flanged ends. Valves shall be coated in accordance with AWWA C550.
  - b. Resilient seated design manufactured by American R-B Clow, Mueller, M&H Valve Company or equal.
2. Valves for Wastewater Service (NOT USED)
3. At the CONTRACTOR's option and unless otherwise indicated, any of the listed valve

styles may be used, at no additional cost to the OWNER.

C. Valve Requirements:

1. Double Disc (NOT USED)
2. Double Revolving Disc (NOT USED)
3. Solid Wedge (NOT USED)
4. Resilient Seated:
  - a. Conform to AWWA C509. Also UL and FM approved.
  - b. Internal and external epoxy coating of valve body, including bonnet, per AWWA C550.
  - c. Gate shall be encapsulated with synthetic rubber. It shall be bonded and vulcanized in accordance with ASTM B429 Method B.
  - d. No recesses in valve body.

D. Buried Valves:

1. Conform to the requirements above, except mechanical joint bell ends per AWWA C111. The valve shall be mechanically restrained with Megalug Series 1100 or ENGINEER approved equal. All exposed valve hardware (nuts, bolts, washers, etc.) including bonnet, bonnet cover, stuffing box, gear adaptor and joints shall be Type 304 stainless steel.
2. Non-rising stem design, double o-ring seals for non-geared valves and shall incorporate packing for geared valves.
3. Provide valve box, 2-in operating nut and extension stem and stem cover.

E. Tapping Valves and Sleeves:

1. Tapping valves shall comply with the same requirements as resilient seated gate valves or double revolving disc gate valves except they shall have the flanged end and port opening modified for tapping service. Valves shall be capable of passing a full nominal sized cutter without damage to the valve. The tapping sleeve shall be gray cast iron or ductile iron mechanical joint type with the outlet flange conforming to MSS-SP-60.
2. All water valves, 4-in and larger, shall be iron body gates, bronze trim, flanged ends, O.S. & Y. pattern, solid wedge, rising spindle, Jenkins No. 651, or Hammond 1R-1140.

## 2.06 PLUG VALVES

- A. Plug valves shall be of the offset disc type, ¼ turn, non-lubricated, serviceable (able to be repacked) under full line pressure and capable of sealing in both directions at the rated pressure. The disc shall be completely out of the flow path when open. Plug valves specified herein shall be by DeZurik, Clow, M&H, Val-Matic, or equal. All Manufacturers, named or otherwise, must comply completely with the specification.



1. For clean liquid or screened sewage, all size plug valves shall have a minimum port area of 80 percent.
  2. On sludge and scum lines, all valves 24-in and larger shall have a minimum 100 percent open port area; for all other valves, a minimum port area shall be 80 percent when measured by the percent cross-sectional area of equivalent size (nominal same diameter) pipe.
  3. All plug valves for what ever service, shall be capable of passing "pigging" cleaning equipment (using a Girard or similar cleaning pig of full nominal pipeline diameter) in either direction and Manufacturer shall so certify that this may be done without the use of special equipment.
- B. Valves shall be rated at minimum 175 psi W.O.G. (Water, Oil, and Gas) working pressure for sizes 4-in to 12-in inclusive and at minimum 150 psi W.O.G. working pressure for sizes 14-in and larger.
1. All plug valves under this paragraph shall be performance, leakage and hydrostatically tested in accordance with AWW A C504, except as herein modified. '.
  2. At the above rated minimum working pressures, the valves shall be certified by the Manufacturer as permitting zero leakage for a period of at least one-half hour with pressure applied to the seating face.
  3. At the request of the ENGINEER, the valve Manufacturer may have to perform a valve seat leakage test, witnessed by the ENGINEER to prove compliance with these Specifications.
- C. Valve bodies shall be of cast iron, 30,000 psi tensile strength, ASTM A 126, Grade B, or of ductile iron, ASTM A536 and of the top entry, bolted bonnet design, cast with integral flanges conforming to the connecting piping. All exposed bolts, nuts and washers shall be zinc or cadmium-plated, except for buried or submerged valves, which shall have Type 316 stainless steel hardware.
- The valve disc shall:
1. Be cast iron ASTM A 126, Grade B, or ductile iron, ASTM A536, Grade 65-45-12.
  2. Be removable without removing the valve from the line.
  3. Have an integral upper and lower shaft which shall have seals on the upper and lower journals to prevent entrance of solids into the journals.
  4. Be one piece for valves up to 14-in and maximum two piece for larger valves.
- D. Shaft bearings shall be permanently lubricated, rigidly backed TFE, stainless steel or bronze at both upper and lower stem journals. The operator shaft shall have easily replaceable seals, which shall be externally adjustable and repackable without removing the bonnet from the valve, or shall have self adjusting packing.
- E. The valve seating surface shall provide full 360 degree seating by contact of a resilient seating material on the disc mating with welded-in high nickel content overlay seating surface in the body.

1. The seating design shall be resilient and of the continuous interface type having consistent opening and closing torques and shall be non-jamming in the closed position. Screw-in seats shall not be acceptable.
  2. Discs shall have a full resilient facing of neoprene or Buna-N.
- F. The methods of mounting the actuator to the valve shall provide an air gap between the two. Actuator shall clearly indicate valve position and an adjustable stop shall be provided. Construction of actuator housing shall be semi-steel. Hardware on actuators shall be of the same materials as the valves.
- G. Unless otherwise required, due to location or operation, each valve 6-in and smaller shall be provided with its own securely attached lever. Provide adjustable limit stops for both opening and closing and a clearly marked position indicator.
- H. Plug valves shall be installed so that the direction of flow through the valve and the shaft orientation is in accordance with the Manufacturer's recommendations. Unless otherwise noted, shaft shall be horizontal, with plug opening up.

## 2.07 BALL VALVES

### A. Ferrous Ball Valves:

1. Ball valves for mainline or water service shall be either ductile iron or carbon steel body, full bore, fire-safe, rated for a line pressure of 150 psig. Except as noted, ball valves shall comply with AWWA C507.
2. The design of the valve shall be such that it shall provide suitable seating in both directions. In order to determine the position of the ball within the valve (open or closed), there shall be an easily visible, permanent, indicator located conspicuously on the valve. Ball valves shall have Type 316 stainless steel seating surfaces. Seats shall be Type 304 stainless steel. The fully open port area shall be approximately 100 percent of the nominal pipe area.
3. Valve shafts shall be ground and polished and shall be Type 304 stainless steel. Teflon-lined bearings shall be supplied in both trunnions of the valve body.
4. The valves shall be constructed so that the seals, seats and balls are accessible for replacement without dismantling the piping. The valves shall not require lubrication but shall have stuffing boxes which can be packed with the valve in service without undue leakage. Ball valves shall be as manufactured by Henry Pratt Co., Aurora, IL; Williamette, Portland, or equal.
5. Valve actuators shall conform to AWWA C507 and as specified herein.

- B. Ball valves for water piping shall be manual or electric actuated (as shown on the Drawings), bronze, resilient seated, regular port, threaded two piece bolted body type valves. The body and cap shall be of brass, ASTM B30, the ball and stem of Type 316 stainless steel and the seats and seals of TFE. The valves shall have full floating ball and shall be non lubricated. Valve seats shall be easily accessible and replaceable. Valves shall be rated to 250 psi and shall be as manufactured by Neles-Jamesbury; WKM or equal.

## 2.08 CHECK VALVES

- A. Swing check valves, sizes 2-1/2 inches through 12 inches shall be spring and lever operated with bronze disc facing and flanged ends with a maximum working pressure of 175 psig and test pressure of 350 psig.
- B. Swing check valves, sizes 14 inches through 24 inches shall be spring and lever operated with bronze disc facing and flanged ends with a maximum working pressure of 150 psig and test pressure of 300 psig.
- C. Swing check valves, sizes 4 inches and smaller shall use bronze disc ASTM B584.
- D. Valves shall meet all applicable parts of ANSI/AWWA C508 Standard.
- E. Valves for above grade shall be flanged end. Flanged end dimensions and drilling shall comply with ANSI B16.1, Class 125. Swing check valves for buried service shall be mechanical joint ends.
- F. The valve body shall be constructed of ductile or cast iron per ASTM A126, Class B, or ASTM A536, bronze mounted (IBBM).
- G. Valves shall be located above grade unless otherwise noted in the Drawings and Specifications.
- H. Valves shall have an O-ring sealed stuffing box.
- I. Valves shall have adjustable spring tension to control opening and closing of the clapper.
- J. Valves shall be installed so that the direction of flow through the valve and the shaft orientation is in accordance with the Manufacturer's recommendations.
- K. Swing check valves specified herein shall be by Mueller Company, Model No. 2600 for above grade installations, or ENGINEER approved equal. All Manufacturers, named or otherwise, must comply completely with the specification.

## 2.09 AIR RELEASE VALVES

- A. Air release valve assembly shall be furnished and installed on the reuse water transmission main as shown on the drawings.
- B. Air release or valve assembly shall consist of a combination short body, air release-vacuum breaker valves, installed in a manhole with vented manhole cover, gate valve, fittings, tapping saddle and connecting piping to the main.
- C. Air release valves shall be installed to release any small accumulations of air, which may collect while pipe is in operation and under pressure.
- D. Air release valves on a HDPE pipe shall utilize an electrofusion corp saddle with stainless steel outlet as manufactured by Central Plastics or equal.
- E. The air release valves shall be Val-Matic Model 42 or engineer approved equal.
- F. The small orifice assembly air release valve shall automatically release air accumulations from the pipe while under positive pressure.
- G. When the valve body fills with air, the float ball shall fall to open the small orifice and exhaust the air to atmosphere.

- H. When the air has been exhausted, the float ball shall be buoyed up and tightly close the small orifice.
- I. The small orifice assembly shall be furnished with cast iron body and cover (ASTM A126-B).
- J. The float ball shall be constructed of stainless steel and attached to a stainless steel lever mechanism.
- K. A resilient, Buna-N seat shall be attached to the lever mechanism for drop-tight closure.
- L. Valves shall be corrosion resistant, suitable for reuse water transmission main application, and shall automatically function to release to the atmosphere both large and small amounts of air that accumulate in the pipeline.
- M. Once the air has been exhausted, both valves shall seal tightly to prevent liquid leakage.
- N. The valve shall also function to admit air into a line, tank, or chamber under emergency conditions or when it is being drained.
- O. The capacity and pressure rating of the valve is dependent on the diameter of the precision orifice in the cover.
- P. The Orifice Size shall be 5/32-inch. A large inlet connection is required for proper air and water exchange.
- Q. The reuse water air release valves inlet size shall be 2-inch NPT for reuse water mains.
- R. The reuse water air release valves outlet size shall be 1/2-inch NPT for reuse water mains.
- S. The Air Release Valves shall be automatic float operated valves designed to release accumulated air from a piping system while the system is in operation and under pressure and installed in a concrete box as shown on the drawings.
- T. Box and like shall be of the necessary size to the valve.
- U. To connect the air valve, a corporation stop shall be tapped into the main using the procedures as recommended by the ductile iron pipe manufacturer.
- V. The corporation stop shall be Mueller H-10045 or approved equal.
- W. The valve body shall be threaded with NPT inlets and outlets.
- X. The body inlet connection shall be hexagonal for a wrench connection.
- Y. The valve shall have two additional NPT connections for the addition of gauges, testing and draining.
- Z. The valve body and cover shall be constructed of ASTM A126 Class B cast iron working pressures of 300 psig, with resilient seats, rubber covered floats and no levers.
- AA. The cover shall be bolted to the valve body and sealed with a flat gasket.

- BB. Resilient seats shall be replaceable and provide drop tight shut off to the full valve pressure rating.
- CC. Floats shall be unconditionally guaranteed against failure including pressure surges.
- DD. Mechanical linkage shall provide sufficient mechanical advantage so that the valve will open under full operating pressure.
- EE. The orifice, float and linkage mechanisms shall be constructed of Type 304 stainless steel.
- FF. Non-metallic floats or linkage mechanisms are not acceptable.
- GG. The manufacturer shall demonstrate a minimum of five (5) years experience in the manufacture of air valves.
- HH. The valves shall be manufactured and tested in accordance with American Water Works Association Standard (AWWA) C512.
- II. The manufacturer shall provide test certificates, dimensional drawings; parts list drawings, and operation and maintenance manuals.
- JJ. The exterior of the valve shall be coated with a universal alkyd primer.
- KK. Air Release Valves shall be as manufactured by Val-Matic Valve & Mfg. Corporation Model No. 38.6, Elmhurst, IL. USA or approved equal.

#### 2.10 AIR/VACUUM VALVES (NORMAL OPERATION)

- A. The large orifice assembly air and vacuum valve shall automatically exhaust air from a pipeline during the initial filling of the pipeline.
- B. The large orifice assembly shall not blow shut while exhausting air, even while venting air at sonic velocity.
- C. When all air has been exhausted from the pipeline, the large orifice float ball shall be buoyed up to seat tightly against a resilient seat ring.
- D. The large orifice float ball shall remain tightly closed while the pipeline is under positive pressure.
- E. Should the pipeline pressure fall below atmospheric pressure (such as during draining or a line break), the large orifice float ball shall automatically fall away from the seat ring and permit air to enter the pipeline.
- F. The large orifice assembly shall be furnished with cast iron body and cover (ASTM A126-B).
- G. A resilient, Buna-N seat ring shall be affixed to the valve cover.
- H. The float ball shall be constructed of stainless steel with a minimum pressure rating of 1,000 psi. [The float ball shall be free floating within the valve body; guide stems, linkages or levers attached to the float are not acceptable.]
- I. Unit shall be manufactured by GA; APCO; Val-Matic or equal. Special type for use with

non-clean fluids shall be provided.

## 2.11 COMBINATION AIR AND AIR/VACUUM OR VACUUM RELIEF VALVES

- A. Valves shall be corrosion resistant, suitable for reuse water application. Combination air valve assembly shall be furnished and installed on the reuse water transmission main as shown on the drawings.
- B. Combination air valve assembly shall consist of a single body, combination air release and air/vacuum valves, installed in a manhole with vented manhole cover, gate valve, fittings, tapping saddle and connecting piping to the reuse water main. Manhole and like shall be of the necessary size to the valve.
- C. Combination air valves shall be automatic float operated valves and installed to release large accumulations of air during the filling of the piping system and close upon liquid entry.
- D. The valve shall open during draining or if a negative pressure occurs.
- E. The valve shall also release accumulated from a piping system while the system is in operation and under pressure.
- F. The capacity and pressure rating of the valve is dependent on the diameter of the precision orifice in the cover.
- G. The large orifice diameter shall be 2-inch and the air release orifice shall be 3/32.”
- H. A large inlet connection is required for proper air and water exchange.
- I. The reuse water combination air valves inlet and outlet size shall be 2-inch NPT.
- J. To connect the air valve, a corporation stop shall be tapped into the main using the procedures as recommended by the ductile iron pipe manufacturer.
- K. The corporation stop shall be Mueller H-10045 or approved equal.
- L. The single body valve shall be threaded with NPT inlets and outlets. The NPT inlets and outlets shall be equal to the nominal valve size.
- M. The body inlet connection shall be hexagonal for a wrench connection.
- N. The valve shall have two additional NPT connections for the addition of gauges, testing and draining.
- O. The combination air valve shall be furnished with cast iron body and cover (ASTM A126-B).
- P. The float ball, guide shafts, and bushings shall be constructed of type 304 stainless steel and attached to a stainless steel lever mechanism.
- Q. A resilient, Buna-N seat shall be attached to the lever mechanism for drop-tight closure. Non-metallic floats or linkage mechanisms are not acceptable.
- R. Single body combination valves shall have an expanded outlet to provide full arc around the guide mechanism.

- S. The valve shall have a double guided plug and an adjustable threaded orifice.
- T. The plug shall be protected against direct water impact by an internal baffle.
- U. The plug shall have a precision orifice drilled through the center stem.
- V. The cover shall be bolted to the valve body and sealed with a flat gasket.
- W. Resilient seats shall be replaceable and provide drop tight shut off to the full valve pressure rating.
- X. Floats shall be unconditionally guaranteed against failure including pressure surges.
- Y. Mechanical linkage shall provide sufficient mechanical advantage so that the valve will open under full operating pressure.
- Z. The exterior of the valve shall be coated with a universal alkyd primer.
- AA. The manufacturer shall demonstrate a minimum of five- (5) years experience in the manufacture of air valves.
- BB. The valves shall be manufactured and tested in accordance with American Water Works Association Standard (AWWA) C512.
- CC. The manufacturer shall provide test certificates, dimensional drawings; parts list drawings, and operation and maintenance manuals.
- DD. Air Valves shall be as manufactured by Val-Matic Valve & Mfg. Corporation engineer approved equal.

#### 2.12 PRESSURE RELIEF VALVES FOR AIR

- A. Pressure relief valves shall be designed for air and built to ASME standards and shall be National Board Certified.
- B. The Valve shall have a one-piece brass body, chrome steel ball on brass seat, silicone rubber seal, and stainless steel spring.
- C. The Preset pressure limit of 100 psi shall be tested and sealed by the manufacturer.
- D. The pressure relief valve shall have a bubble tight seal within 10% of set pressure.
- E. The pressure relief valve shall be manufactured by Control Devices, Inc. or ENGINEER-approved equal.

#### 2.13 INSULATING FITTINGS

Fittings shall be of type to provide control of electrolysis and equal to "Dielectric" as manufactured by Watts Regulator Co., or equal.

#### 2.14 SURFACE PREPARATION AND SHOP COATINGS

- A. Notwithstanding any of these Specifications, all coatings and lubricants in contact with non-potable water shall be certified as acceptable for use with that fluid.

- B. In case of a conflict, the requirements of this Section govern.
- C. If the Manufacturer's requirement is not to require finished coating on any interior surfaces, then Manufacturer shall so state and no interior finish coating will be required, if acceptable to the ENGINEER.
- D. The exterior surface of various parts of valves, operators, floor-stands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease or other foreign matter and thereafter one shop coat of an approved rust-inhibitive primer such as Inertol Primer No. 621 shall be applied in accordance with the instructions of the paint Manufacturer or other primer compatible with the finish coat provided.
- E. Unless otherwise noted, interior ferrous surfaces of all valves shall be given a shop finish of an asphalt varnish conforming to AWWA C509, (except mounting faces/surfaces) or epoxy AWWA C550 with a minimum thickness of 4 mil.
- F. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.
- G. Mounting surfaces shall be especially coated with a rust preventative.
- H. Special care shall be taken to protect uncoated items and plastic items, especially from environmental damage.

#### 2.15 FACTORY INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

- A. Factory inspection, testing and correction of deficiencies shall be done in accordance with the referenced Standards and as noted herein.
- B. See Division 1 for additional requirements. Also refer to Part 1 of this Section, especially for required submission of test data to the ENGINEER.
- C. In addition to all tests required by the referenced Standards, the following shall also be factory tested:
  - 1. Pressure regulating valves shall be factory tested at the specified pressures and flows.
  - 2. The non-cavitating butterfly valves, to demonstrate its non-cavitating capabilities.
  - 3. All types of air and vacuum valves.

#### 2.16 VALVE BOXES

- A. Valve boxes shall be provided for all buried valves.
- B. Valve boxes shall consist of cast iron base and adjustable top section with cover, which shall be marked "Water, Sewer, or Reuse."
- C. Cast iron extensions shall be provided as required to meet grade.

### PART 3 - EXECUTION



### 3.01 INSTALLATION - GENERAL

- A. All valves and appurtenances shall be installed per the Manufacturer's instructions in the locations shown, true to alignment and rigidly supported.
- B. Any damage to the above items shall be repaired to the satisfaction of the ENGINEER before they are installed.
- C. Install all brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings, or otherwise required.
- D. Before setting these items, the CONTRACTOR shall check all Drawings and figures which have a direct bearing on their location.
- E. The CONTRACTOR shall be responsible for the proper location of valves and appurtenances during the construction of the Work.
- F. All materials shall be carefully inspected for defects in construction and materials. All debris and foreign material shall be cleaned out of openings, etc.
- G. All valve flange covers shall remain in place until connected piping is in place.
- H. All operating mechanisms shall be operated to check their proper functioning and all nuts and bolts checked for tightness.
- I. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the OWNER.
- J. Where installation is covered by a Referenced Standard, installation shall be in accordance with that Standard, except as herein modified, and the CONTRACTOR shall certify such. Also note additional requirements in other parts of this Specification.
- K. Unless otherwise noted, joints for valves and appurtenances shall be made up utilizing the same procedures as specified under the applicable type connecting pipe joint and all valves and other items shall be installed in the proper position as recommended by the Manufacturer.
- L. CONTRACTOR shall be responsible for verifying Manufacturer's torquing requirements for all valves.

### 3.02 INSTALLATION OF MANUAL OPERATIONAL DEVICES

- A. Unless otherwise noted, all operational devices shall be installed with the units of the factory, as shown on the Drawings or as acceptable to the ENGINEER to allow accessibility to operate and maintain the item and to prevent interference with other piping, valves and appurtenances.
- B. For manually operated valves 3-inch in diameter and smaller, valve operators and indicators shall be rotated to display toward normal operation locations.
- C. Floor boxes, valve boxes, extension stems and low floor stands shall be installed vertically centered over the operating nut, with couplings as required and the elevation of the box top shall be adjusted to conform with the elevation of the finished floor surface or grade at the completion of the Contract.

- D. Boxes and stem guides shall be adequately supported during concrete pouring to maintain vertical alignment.

### 3.03 INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

- A. See also Division 1. Take care not to over pressure valves or appurtenances during pipe testing.
- B. If any unit proves to be defective, it shall be replaced or repaired to the satisfaction of the ENGINEER.
- C. Functional Test:
  - 1. Prior to plant start-up, all items shall be inspected for proper alignment, quiet operation, proper connection and satisfactory performance.
  - 2. All units shall be operated continuously while connected to the attached piping for at least 8 hours, without vibration, jamming, leakage, or overheating and perform the specified function.
- D. The various pipe lines in which the valves and appurtenances are to be installed are specified to be field tested.
- E. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the ENGINEER.
- F. Various regulating valves, strainers, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the ENGINEER.

### 3.04 IDENTIFICATION OF VALVES

- A. All valves shall be designated by distinguishing numbers and/or letters on required chart(s) and/or diagram(s).
- B. The CONTRACTOR shall install approved brass tags for all designated items with numbers and/or letters on the tags corresponding to those on the chart(s) and/or diagram(s).
- C. Each valve identification tag to be minimum 19 gauge polished brass: 2-inch diameter.
- D. Each tag to designate appropriate service (1/4 inch stamped black-filled letters) and appropriate valve number (1/2 inch stamped black-filled number).
- E. Tags shall be securely fastened to valves with approved stainless steel screws or rivets, or brass jack chain, in a manner to permit easy reading.
- F. CONTRACTOR shall prepare piping flow diagrams (or re-use those on the contract plans) indicating valve numbers, service, normal position, etc., of each valve.
- G. Diagrams shall be mounted on an ornamental iron frame with hinged plexiglass face for wall mounting. Four (4) frames with plexiglass are required.

- H. The requirements for valve identification specified above applies equally to all valves installed under this and under other sections of these specifications.

### 3.05 CLEANING

All items (including valve interiors) shall be cleaned prior to installation, testing, disinfection and final acceptance.

### 3.06 DISINFECTION

Disinfection of valves and appurtenances shall be in accordance with AWWA Requirements.

### 3.07 SETTING VALVES AND BOXES

- A. Valves and valve boxes as specified in the preceding paragraphs shall be installed where shown on the drawings unless otherwise directed.
- B. Valves shall be set plumb with the base of the valve box centered over the valve and resting on compacted backfill.
- C. The top section of the box shall be set to allow equal movement above and below finished grade.
- D. After being correctly positioned, fill shall be carefully tamped around the valve box for a distance of 4-feet on all sides of the box.
- E. In paved areas, top of the cover shall be flush with the finished paving.
- F. In off-street areas, the cover shall be set 1-inch above existing grade unless otherwise directed by the ENGINEER and a concrete pad shall be poured around the tope of the box as shown in the standard details.

**END OF SECTION 33 51 01**

## **SECTION 33 31 11 - POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE**

### **PART 1 - GENERAL**

#### **1.01 SCOPE OF WORK**

- A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required, and install polyvinyl chloride (PVC) ASTM D3034 (PVC) gravity sewer pipe and appurtenances as shown on the Drawings and as specified herein.

#### **1.02 SUBMITTALS**

- A. The CONTRACTOR shall submit to the ENGINEER not less than 20 calendar days after the date of the Notice to Proceed, a list of materials to be furnished, the names of suppliers and an expected schedule of delivery of materials to the site.
- B. At least 3 days prior to beginning construction of any gravity sewer section or any portion of the system, the CONTRACTOR must submit to the ENGINEER for review "cut-sheets" for that portion to be constructed. The type of the "cut sheets" required shall be presented to the CONTRACTOR by the ENGINEER at the preconstruction meeting. The CONTRACTOR shall supply all "cut sheets."
- C. Furnish in duplicate to the ENGINEER, prior to each shipment of pipe, sworn certificates that all tests and inspections required by the Specifications under which the pipe is manufactured have been satisfied.
- D. The pipe Manufacturer shall inspect all pipe joints for out-of-roundness and pipe ends for squareness. The Manufacturer shall furnish to the ENGINEER a notarized affidavit stating all pipe meets the requirements of American Society of Testing Materials, (ASTM), American Society of Civil Engineers (ASCE), American National Standards Institute (ANSI), etc., these Specifications, and the joint design with respect to square ends and out-of-round joint surfaces.

#### **1.03 REFERENCE STANDARDS**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
  - 2. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
  - 3. ASTM D3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
  - 4. ASTM D3189 - Method for Rubber - Evaluation of Solution BR (Polybutadiene Rubber).
  - 5. ASTM D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
  - 6. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  - 7. ASTM F679 - Specification for Polyvinyl Chloride (PVC) Large-Diameter Plastic

Gravity Sewer Pipe and Fittings.

8. ASTM F758 - Specification for Smooth-Wall Polyvinyl Chloride (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage.
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 QUALITY ASSURANCE

- A. All PVC pipe shall be from a single Manufacturer.
1. The supplier shall be responsible for provisions of all test requirements specified in ASTM D3034.
  2. All tests, hydrostatic and material, if not performed by the Manufacturer as part of the Manufacturer standard quality control procedures, are to be performed by an independent laboratory at the expense of the Manufacturer.
  3. In addition, all PVC pipe to be installed under this Contract may be inspected at the plant for compliance with these specifications by an independent testing laboratory provided by the OWNER.
  4. The CONTRACTOR shall require the Manufacturer's cooperation in these inspections. The cost of plant inspection of all pipe approved for this contract shall be borne by the OWNER.
- B. Inspections of the pipe may also be made by the ENGINEER or other representative of the OWNER after delivery.
1. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though sample pipes may have been accepted as satisfactory at the place of manufacture.
  2. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Care shall be taken in shipping, handling, and laying to avoid damaging the pipe and fittings. Extra care will be necessary during cold weather construction. Any pipe damaged in shipment shall be replaced as directed by the ENGINEER.
- B. Any pipe or fitting showing a crack or which has received a blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- C. While stored, pipe shall be adequately supported from below at not more than 3-foot intervals to prevent deformation. Pipe shall not be stacked higher than 6 feet. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of the sunlight (or delivered to the site so that no pipe is exposed to the sunlight for more than (60) days). Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup when exposed to direct sunlight will not be permitted. Pipe shall be protected from sunlight or weather conditions in accordance with the MANUFACTURER's recommendations.

1.06 INSPECTION, TEST REPORTS, MARKINGS AND SUBMITTALS

- A. All pipe and accessories to be installed under this Contract shall be inspected and tested at the place of manufacture by the MANUFACTURER as required by the Standard Specifications to which the material is manufactured.
- B. Each length of pipe shall be subject to inspection and approval at the factory, point of delivery, and site of work. Sample of pipe to be tested shall be selected at random by the ENGINEER or the testing laboratory and shall be delivered by the CONTRACTOR to the testing laboratory approved by the ENGINEER.
- C. When the specimens tested conform to applicable standards, all pipe represented by such specimens shall be considered acceptable based on the test parameters measured. Copies of test reports shall be submitted to the ENGINEER before the pipe is installed in the project. Acceptable pipe will be stamped with an appropriate monogram under the supervision of the testing laboratory.
- D. In the event that any of the test specimens fail to meet the applicable standards, all pipe represented by such tests shall be subject to rejection. The CONTRACTOR may furnish two additional test specimens from the same shipment or delivery for each specimen that failed and the pipe will be considered acceptable if all of these additional specimens meet the requirements of the applicable standards.
- E. Pipe that has been rejected by the ENGINEER shall be removed from the site of the work by the CONTRACTOR and replaced with pipe which meets these specifications.
- F. Other testing requirements specific to the type of pipe are included under the appropriate paragraph in Part 2, below.
- G. All 6-inch through 12-inch pipe and fittings shall be marked per Section No. 12 "Marking" of ASTM D3034. All 18-inch and 27-inch pipe and fittings shall be marked per Section 11 "Marking" of ASTM F679. For all pipe (6-inch through 12-inch), the MANUFACTURER's code including year, month, day, shift, plant and extruder of manufacture shall be clearly marked on each pipe section.
- H. Prior to shipment of the pipe and fittings to the project site, the CONTRACTOR shall submit to the ENGINEER, test reports and certifications as described below duly certified by the MANUFACTURER's testing facility or an independent certified testing laboratory demonstrating full compliance with the applicable ASTM specifications described above. Certification from the supplier is NOT acceptable.
  - 1. An original plus two copies of the following shall be submitted to the ENGINEER:
    - a) The name, address and phone number of the pipe and fittings MANUFACTURER.
    - b) The location of the plant at which they will be manufactured.
- I. Certification and Certified Test Reports that each LOT of pipe has been manufactured, sampled and tested per Section 8 "Test Methods" of ASTM D3034 for 6-inch through 15-inch diameter and Section 11 "Marking" of ASTM F679 for 18-inch through 27-inch diameter pipe. The OWNER shall be provided in writing with the means to cross reference the markings with the certification and test reports (i.e., date of manufacture, lot number and shift number, etc.).

1. If this information is marked on the pipe in a code, the markings shall be decoded in writing.
2. A letter of certification from the fittings MANUFACTURER shall be provided for fittings stating compliance with ASTM D3034 for 6-inch through 15-inch diameter and with ASTM F679 for 18-inch through 27-inch.

## PART 2 - PRODUCTS

### 2.01 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. PVC gravity pipe and fittings 6-inches through 12-inches nominal diameter shall be solid wall and shall be type PSM, PVC SDR 35 with full diameter dimensions and shall conform to ASTM D3034, for sizes 4-inch through 15-inch and shall conform to ASTM F679 for sizes 18-inch through 27-inch. Straight pipe shall be furnished in lengths of not more than 13-feet. Saddle wyes will not be allowed. All PVC shall have a cell classification of 12454 B or C.
- B. For depths of cover through 18 feet, a minimum wall thickness of SDR-35 is required. For depths of cover greater than 18-feet, a minimum wall thickness of SDR-26 is required. Fittings shall be either integrally cast (factory molded) or factory solvent welded and a separate section from the mainline pipe. SDR 26 fittings shall be used with SDR 26 pipe and SDR 35 fittings shall be used with SDR 35 pipe. At any time in a manhole run the depth of cover exceeds 18-ft, SDR 26 shall be used.
- C. The supplier shall be responsible for the performance of all inspection and testing requirements specified in ASTM D-3034, ASTM D-3212, D3189, F679 and F789, as applicable. Complete records of inspections, examinations and tests shall be kept and submitted to the ENGINEER. The ENGINEER reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that materials and services conform to the prescribed requirements.
- D. The pipe shall be joined with an integral bell and spigot push-on type gasketed joints. Each integral bell joint shall consist of a formed bell with an integral wall section of a solid cross-section elastomeric gasket securely locked in place to prevent displacement during assembly. Gaskets shall conform to ASTM F-477. Joints shall permit contraction, expansion and settlement, and yet maintain a watertight connection. Joints shall be tested in accordance with ASTM F477, D3139 or D3212.
- E. PVC sewer fittings shall conform to the requirements of ASTM D-3034 specification. Fittings in sizes through 8-inches shall be molded in one piece with elastomeric joints and minimum socket depths as specified in Sections 6.2 and 7.3.2 of the ASTM D-3034 specification. Gaskets for elastomeric joints shall be molded and shall conform to ASTM F-477 specification. Fittings 10-inches and larger shall be molded or fabricated from pipe meeting ASTM D-3034 with MANUFACTURER's standard pipe bells and gaskets.
- F. All fittings and accessories shall be furnished by one pipe supplier and shall have bell and/or spigot configurations compatible with the pipe.

### 2.02 IDENTIFICATION

- A. Each length of pipe and each fitting shall be marked with the name of the MANUFACTURER, size, and class. All gaskets shall be marked with the name of the MANUFACTURER, size, and proper insertion directions. A color sample of the PVC pipe and fittings shall be submitted to the ENGINEER for approval prior to fabrication of any pipe and accessories.

- B. All below ground polyvinyl chloride pipe and fittings shall have an identification color code. Gravity sewer pipe and service laterals - Green, similar to Kop Coat No. 0336.
- C. All polyvinyl chloride pipe shall have identification marking tape similar to the color listed above.

### PART 3 - EXECUTION

#### 3.01 LAYING POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. Polyvinyl Chloride (PVC) gravity sewer pipe shall be laid in accordance with the instructions of the MANUFACTURER and as specified herein. As soon as the excavation is completed to normal grade, as indicated on the Drawings, the CONTRACTOR shall immediately bed the pipe as specified in Section 312200 in the trench, to conform accurately to the line and grade indicated on the Drawings. Embedment of pipe shall conform to the details shown on the Drawings and ASTM D2321, "Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe." Bell holes shall be excavated so that after installation only the pipe barrel shall bear upon the trench bottom. Proper selection and placement of bedding and backfill materials are necessary to minimize deflection of the pipe diameter. No blocking under the pipe will be permitted.
- B. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/4-inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the MANUFACTURER shall be explicitly followed.
- C. The CONTRACTOR shall use care in handling and installing pipe and fittings. Storage of pipe on the job site shall be done in accordance with the pipe MANUFACTURER's recommendation and with approval of the ENGINEER. Under no circumstances shall pipe or fittings be dropped either into the trench or during unloading. The interior of the pipe shall be kept clean of oil, dirt and foreign matter, and the machined ends and couplings shall be wiped clean immediately prior to jointing.
- D. The CONTRACTOR shall use a PVC pipe cutter where necessary to cut and machine all PVC pipe in the field. A "full insertion mark" shall be provided on each field cut pipe end. Field-cut pipe shall be beveled with a beveling tool made especially for plastic pipe. Bevels shall be in accordance with the MANUFACTURER's requirements.
- E. Each length of pipe and each fitting shall be marked with the nominal size, the SDR designation, the name of the MANUFACTURER or his trademark, and the date of manufacture.
- F. Rubber gaskets shall be marked with MANUFACTURERs identification sizes and proper insertion direction.
- G. Pipe stubs for all future connections shall be not less than 26-ft. in length unless otherwise shown on the Drawings. Install watertight plugs where required.
- H. The laying of the pipe in finished trenches shall begin at the lowest point, with the spigot ends pointing in the direction of flow. The interior of the pipe and the jointing seal shall be free from sand, dirt, and trash before installing in the line. Extreme care must be taken to keep the bells of the pipe free from dirt and rocks so joints may be properly assembled without overstressing the bells. The jointing of the pipe shall be done in strict accordance with the pipe MANUFACTURER's instructions and shall be done entirely in the trench. Tolerances are 1-inch on grade or 5 percent of the design slope, whichever is



smaller, and 6-inches on line in any section between manholes. Deviations exceeding these tolerances shall be grounds for rejection of the line.

- I. All pipe shall be sound and clean before installation. When installation is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plug or other approved means to prevent foreign material from entering the pipe. Good alignment shall be preserved during installation. The deflection of joints shall not exceed that recommended by MANUFACTURER. Fittings for service laterals, in addition to those shown on the plans, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench.
- J. The ENGINEER may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such, and immediately removed from the job site.
- K. Each length of the pipe shall be shoved home against the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be "pulled" or "cramped".
- L. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.
- M. Precautions shall be taken to prevent flotation of the pipe in the trench.
- N. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the screened gravel backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, screened gravel shall be placed to fill any voids created and the screened gravel and backfill shall be recompacted to provide uniform side support for the pipe.
- O. Laser shall be used for maintaining pipe alignment.

### 3.02 JOINTING POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS

- A. PVC push-on sewer pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the MANUFACTURER. The pipe MANUFACTURER shall furnish information and approve the installation of at least the first ten (10) joints of each pipe laying crew. The pipe MANUFACTURER shall visit the site on a quarterly basis to supervise and inspect and certify installation.
- B. All manhole connections shall be as shown on the Drawings except that concrete and mortared connections shall be equipped with an integral O-ring or other sealant such that a positive watertight seal is established.

### 3.03 TESTS FOR GRAVITY SEWERS - GENERAL

- A. Gravity sewers shall be required to pass a leakage test before acceptance. Leakage tests may be by the infiltration test or exfiltration test, depending on the level of the groundwater table or by the low-pressure air test all as described below.
- B. Water infiltration or exfiltration or air loss, as applicable, rates will be measured by the

ENGINEER. The tests shall be performed by the CONTRACTOR under the observation of the ENGINEER.

- C. The groundwater height above the installed pipe shall be determined by a system of monitoring wells. The CONTRACTOR shall submit his method of establishing the groundwater height to the ENGINEER for approval prior to commencing testing.
- D. Sewers will be checked by the ENGINEER prior to final restoration or the placing of asphalt to determine if pipe displacement has occurred. The CONTRACTOR shall give a minimum of 48 hours notice to the ENGINEER and furnish all necessary test equipment and labor required to allow the ENGINEER to perform this check. The CONTRACTOR shall also be responsible for pumping the system down and maintaining the pumped down condition for all pump station service areas.

The equipment shall include but not be limited to the following:

- 1. Hand held spotlight minimum 300,000 candle power and a power source for the light.
  - 2. Appropriate ladders necessary to allow access to all manholes.
  - 3. Mirrors
  - 4. All equipment and manpower necessary to comply with confined space entry requirements (gas sensors, blowers, safety harness, etc.)
  - 5. On pipelines under 12-inch in diameter the light shall be flashed down the center of the pipe from the upstream manhole and viewed from the downstream manhole. Measurements shall be taken at the top, each side and the bottom to determine the moon designation of the pipeline (example 8-inches - 1-inches out of alignment 7/8 moon, 2-inches out of alignment 3/4 moon, etc.). On pipelines 12-inches in diameter and larger the light shall be held at the upstream manhole and will be placed at the top, each side and bottom to allow for measurements to be taken in the same manner as for the pipelines under 12-inches in diameter.
  - 6. Pipelines under 12-inches in diameter or greater which have a 7/8 moon or less shall be televised and recorded on video tape (as required in other sections of this specification) to verify the extent of the misalignment to determine in the opinion of the ENGINEER/OWNER if a point repair or relaying of the pipeline is necessary prior to any further restoration work being performed. The cost to maintain all traffic and roadways until a determination as to the acceptability of the pipeline is made shall be at the expense of the CONTRACTOR in addition to the actual cost of the repair.
- E. Allowable Deflection Test
- 1. Deflection shall be measured with a rigid mandrel (Go/No-Go) device cylindrical in shape and constructed with a minimum of 9 or 10 evenly spaced arms or prongs. Drawings of the mandrel with complete dimensions shall be submitted to the ENGINEER for each diameter of pipe to be tested.
  - 2. Pipe deflection shall be measured not less than 90 days after the backfill or permanent pavement base has been completed as specified and shall not exceed 5 percent of the base inside diameter of the pipe as listed in the following table.

<b>SDR-35</b>		<b>SDR-26</b>		
<b>Nominal SizeDiameter (Inches)</b>	<b>Base Inside Mandrel (Inches)</b>	<b>5% Deflection Diameter (Inches)</b>	<b>Base Inside Mandrel (Inches)</b>	<b>5% Deflection (Inches)</b>
8	7.665	7.28	7.488	7.11
10	9.563	9.08	9.342	8.87
12	11.361	10.79	11.102	10.55
15	13.898	13.20	13.575	12.90

<b>TYPE T 1</b>			<b>TYPE T-2</b>	
<b>Nominal SizeDiameter (Inches)</b>	<b>Base Inside Mandrel (Inches)</b>	<b>5% Deflection Diameter (Inches)</b>	<b>Base Inside Mandrel (Inches)</b>	<b>5% Deflection (Inches)</b>
18	16.976	16.13	17.054	16.20
21	20.004	19.01	20.098	19.09
24	22.480	21.36	22.586	21.46
27	25.327	24.06	25.446	24.17

3. If the CONTRACTOR performs the deflection testing rather than employing an approved test lab, the following shall apply:
4. The CONTRACTOR shall furnish the rigid mandrel, labor, materials and equipment necessary to perform the tests as approved by the ENGINEER. The mandrel shall be pulled through by Hand or a Hand operated reel through all sewer lines in the presence of the ENGINEER. Prior to performing the deflection tests, the CONTRACTOR shall submit to the ENGINEER certification that the minimum 9-arm mandrels are preset as stated above. Each mandrel shall be engraved with the following:
  - a. **Serial Number;**
  - b. **Nominal pipe diameter;**
  - c. **Either "ASTM D3034", year and either "SDR-35" or "SDR-26"**
  - d. **or "ASTM F679", year and either "Type T-1" or "Type T-2"**
  - e. **% deflection as stated above.**
5. If the mandrel fails to pass any section of pipe, the CONTRACTOR shall excavate to the point of excess deflection and carefully compact around the point where excess deflection was found at no additional cost to the OWNER. After the permanent pavement base has been recompacted and resealed, the line shall be retested. If the mandrel fails to pass a second time, the section shall be replaced and retested. Rerounding is NOT permitted.
- F. The CONTRACTOR shall repair all visible leaks in manholes even though the leakage test requirements are met.
- G. The ends of branches, laterals, tees, wyes, and stubs to be included in a test section shall be plugged to prevent water or air leakage. All plugs shall be secured to prevent blowout due to internal pressure. A test section is defined as the length of sewer between manholes.

3.04 LEAKAGE TEST - INFILTRATION METHOD

- A. The water infiltration test shall not be considered a valid leakage test unless the top

surface of the groundwater level is at least 4-feet or more above the pipe crown during the test measurement. The rate of infiltration of water into the sewers, including manholes and appurtenances, shall not exceed 200 gallons per day per inch diameter per mile of sewer. In the event groundwater does not submerge the pipe as specified, the CONTRACTOR shall conduct an exfiltration test described hereinafter.

- B. A visual inspection and an infiltration test will be conducted on all completed sewers 30-inches or more when they are submerged by groundwater as specified above. The CONTRACTOR shall provide facilities to stop inflow from adjacent sections of sewer and to provide pondage to permit measurement of infiltration. Visible leaks, defective joints, and defective pipe shall be satisfactorily replaced.

### 3.05 LEAKAGE TEST - EXFILTRATION METHOD

- A. Sewers not submerged by groundwater shall be tested for exfiltration or, if approved, by low-pressure air method. The ENGINEER reserves the right to waive the exfiltration test on any section of sewer based on his evaluation of the results of previous tests.
- B. The hydrostatic head for test purposes shall be 4-feet or more above the sewer crown at the upstream end. Any arrangement of testing equipment which will provide observable and accurate measurement of water leakage under the specified conditions will be permitted. The rate of exfiltration of water out of the sewers, including manholes and appurtenances, shall not exceed 200 gallons per day per inch diameter per mile of sewer. Visible leaks, defective joints, and defective pipe shall be satisfactorily replaced.
- C. The sewer test section may be filled 24 hours prior to time of exfiltration testing, if desired, to permit normal absorption into the sewers walls to take place.

### 3.06 LEAKAGE TEST - LOW PRESSURE AIR METHOD (PREFERRED METHOD)

- A. Test Procedure. The following test procedures shall be used in making each test:
  - 1. The section of sewer line to be tested shall be flushed and cleaned prior to conducting the low-pressure air test to clean out any debris, wet the pipe, and produce more consistent results.
  - 2. Isolate the section of sewer line to be tested by means of inflatable stoppers or other suitable test plugs. One of the plugs shall have an inlet tap, or other provision for connecting a hose to a portable air source.
  - 3. If the test section is below the groundwater level, determine the height of the groundwater above the springline of the pipe at each end of the test section and compute the average. For every foot of groundwater above the pipe springline, increase the gauge test pressure by 0.43 pounds per square inch.
  - 4. Connect the air hose to the inlet tap and a portable air source. The air equipment shall consist of necessary valves and pressure gauges to control the rate at which air flows into the test section and to enable monitoring of the air pressure within the test relief device to prevent the possibility of loading the test section with the full capacity of the compressor.
  - 5. Add air slowly to the test section until the pressure inside the pipe is raised to 4.0 psig greater than the average back pressure of any groundwater that may be over the pipe.
  - 6. After a pressure of 4.0 psig is obtained, regulate the air supply so that the

pressure is maintained between 3.5 and 4.0 psig (above the average groundwater back pressure) for a period of two-minutes to allow the air temperature to stabilize in equilibrium with the temperature of the pipe walls.

7. Determine the rate of air loss by the time pressure-drop method. After the two-minute air stabilization period, disconnect the air supply and adjust the pressure to 3.5 psig above the average to drop from 3.5 psig to 2.5 psig shall be determined by means of a stopwatch and this time interval will be compared to the required time in the tables to determine if the rate of air loss is within the allowable time limit. If the time is equal to or greater than the times indicated in the tables, the pipeline shall be deemed acceptable.
  8. Defective joints, fittings and pipe shall be satisfactorily replaced.
- B. The pipe shall be tested between adjacent manholes. The test time for the air pressure to drop the specified one pound shall be as listed below:

<b>Pipe Diameter "D" in Inches</b>							
<b>Length of Test Sec. "L" (ft.)</b>	<b>8</b>	<b>10</b>	<b>12</b>	<b>15</b>	<b>18</b>	<b>21</b>	<b>24</b>
25	0.18	0.28	0.40	1.02	1.29	2.01	2.38
50	0.35	0.55	1.19	2.04	2.58	4.03	5.17
75	0.53	1.23	1.59	3.06	4.27	6.04	7.55
100	1.11	1.50	2.38	4.08	5.56	8.05	10.39
125	1.28	2.18	3.18	5.09	7.26	9.55	11.20
150	1.46	2.45	3.58	6.11	8.30	9.55	11.20
175	2.03	3.13	4.37	7.05	8.30	9.55	11.20
200	2.21	3.40	5.17	7.05	8.30	9.55	11.20
225	2.38	4.08	5.40	7.05	8.30	9.55	11.20
250	2.56	4.35	5.40	7.05	8.30	9.55	11.20
275	3.14	4.43	5.40	7.05	8.30	9.55	11.20
300	3.31	4.43	5.40	7.05	8.30	9.55	11.20
325	3.47	4.43	5.40	7.05	8.30	9.55	11.20
350	3.47	4.43	5.40	7.05	8.30	9.55	11.20
400	3.47	4.43	5.40	7.05	8.30	9.55	11.20
425	3.47	4.43	5.40	7.05	8.30	9.55	11.20
450	3.47	4.43	5.40	7.05	8.30	9.55	11.20
475	3.47	4.43	5.40	7.05	8.30	9.55	11.20
500	3.47	4.43	5.40	7.05	8.30	9.55	11.20

- C. For sewer diameter between 27-inches and 36-inches inclusive, the pipeline may be tested between adjacent manholes, or segmentally. The test time shall be in accordance with the following formula.

$$T = .00493 (D \times D) L$$

**where:**

*T* = Test Time, Seconds; *D* = Diameter, Inches; *L* = Length of test Section, Feet.

### 3.07 FINAL SEWER CLEANING

- A. Prior to final acceptance and final manhole-to-manhole inspection of the sewer system by the ENGINEER, flush and clean all parts of the system. Remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system at or near the closest downstream manhole. If necessary, use mechanical rodding or bucketing equipment.

- B. Upon the ENGINEER's final manhole-to-manhole inspection of the sewer system, if any foreign matter is still present in the system, reflush and clean the section and portions of the lines as required.

### 3.08 VACUUM TEST OF MANHOLES/WETWELLS

- A. Pretest manhole/wet wells after connections have been completed but before backfilling. Results derived from this test will allow time for necessary repairs to be completed before further construction proceeds and hinders such repairs.
- B. Plug all manhole/wet wells inverts and lift holes. Inverts shall be plugged using suitably-sized pneumatic or mechanical pipeline plugs. The plugs shall be placed a minimum of 6-inches beyond the manhole/wet wells wall to prevent temporary sealing of the inverts. Follow all MANUFACTURER'S recommendations and warnings for proper and safe installation of such plugs. Make sure such plugs are properly rated for the pressures required for the test.
- C. The standard test of 10-inch Hg. (mercury) is equivalent to approximately 5 psig (0.3 bar) back pressure. Unless such plugs are mechanically restrained, it is recommended that the plugs used have a two-times (2X) safety factor or a minimum 10 psig (.7 bar) back pressure usage rating. Brace inverts if lines entering if lines entering the manhole/wet wells have not been backfilled to prevent pipe from being dislodged and pulled into the manhole/wet wells.
- D. Install the vacuum tester head assembly at the top access point of the manhole, preferably the ring area (Figures A and B). Adjust the cross brace to insure that the inflatable sealing element inflates and seals against the straight top section of the manhole/wet wells structure.
- E. Attach the vacuum pump assembly to the proper connection on the test head assembly. Make sure the vacuum inlet/outlet valve is in the closed position.
- F. Following all safety precautions and MANUFACTURER'S instructions, inflate sealing element to the recommended maximum inflation pressure.
- G. Start the vacuum pump assembly engine and allow preset RPM to stabilize.
- H. Open the inlet/outlet ball valve and evacuate the manhole to 10-inch Hg. (0.3 bar).
- I. Close vacuum inlet/outlet ball valve, disconnect vacuum pump, and monitor vacuum for the specified time period (see table below). If the vacuum does not drop in excess of 1-inch Hg. over the specified time period, the manhole is considered acceptable and passes the test. If the manhole fails the test, identify the leaking areas by removing the head assembly, coating the interior surfaces of the manhole with a soap and water solution, and repeating the vacuum test for approximately thirty seconds. Leaking areas will have soapy bubbles. Once the leaks have been identified, complete all necessary repairs and repeat test procedures until satisfactory results are obtained.
- J. Repeat the test procedure after backfilling for final acceptance test.

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#### VACUUM TEST TIMETABLE

#### DIAMETER - INCHES

<b>Depth - Feet</b>	<b>48"</b>	<b>60"</b>	<b>72"</b>
4'	10 sec.	13 sec.	16 sec.
8'	20 sec.	26 sec.	32 sec.
12'	30 sec.	39 sec.	48 sec.
16'	40 sec.	52 sec.	64 sec.
20'	50 sec.	65 sec.	80 sec.
24'	60 sec.	78 sec.	96 sec.
*	05 sec.	6.5 sec.	8.0 sec.

\*Add "T" times for each additional 2' depth. (The values listed above have been extrapolated from ASTM designation C924-85.)

**END OF SECTION 33 31 11**

## **SECTION 33 50 10 - BASIC MECHANICAL REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

#### **1.02 SUMMARY**

This section specifies the basic requirements for mechanical installations. It expands and supplements the requirements specified in sections under "General Requirements."

#### **1.03 ACCESSIBILITY**

- A. The CONTRACTOR shall install equipment and materials to provide required access for servicing and maintenance.
- B. The CONTRACTOR shall coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors.
- C. The CONTRACTOR shall allow ample space for removal of all parts that require replacement or servicing.
- D. The CONTRACTOR shall extend all grease fittings to an accessible location.

#### **1.04 MECHANICAL INSTALLATIONS**

- A. The CONTRACTOR shall coordinate mechanical equipment and materials installation with other building components.
- B. The CONTRACTOR shall verify all dimensions by field measurements.
- C. The CONTRACTOR shall coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- D. The CONTRACTOR shall sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work.
- E. The CONTRACTOR shall install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- F. The CONTRACTOR shall coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

#### **1.05 MECHANICAL SUBMITTALS**

- A. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the CONTRACTOR.



- B. Data from subcontractors and material suppliers directly submitted to the Engineer will not be processed.
- C. Five complete sets of all shop drawings and product data shall be submitted by the CONTRACTOR.

#### 1.06 NAMEPLATE DATA

- A. The CONTRACTOR shall provide permanent operational data nameplate on each item of power-operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics labels of tested compliances, and similar essential data.
- B. The CONTRACTOR shall locate nameplates in an accessible location.

### **PART 2 - PRODUCTS**

#### 2.01 DELIVERY, STORAGE, AND HANDLING

- A. The CONTRACTOR shall deliver products to the project site that are properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications.
- B. The CONTRACTOR shall adequately package and protect products to prevent damage during shipment, storage, and handling.
- C. The CONTRACTOR shall store equipment and materials at the site, unless off-site storage is authorized in writing.
- D. The CONTRACTOR shall protect stored equipment and materials from damage.

### **PART 3 - EXECUTION**

#### 3.01 RECORD DOCUMENTS

The following paragraphs supplement the requirements in sections under “General Requirements.”

- A. The CONTRACTOR shall mark Drawings to indicate revisions to:
  - 1. Piping, size and location both exterior and interior.
  - 2. Actual equipment locations, dimensioned for column lines.
  - 3. Actual inverts and locations of underground piping.
  - 4. Concealed equipment, dimensioned to column lines.
  - 5. Mains and branches of piping systems, with valves and control devices located and numbered
  - 6. Concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.).
  - 7. Concealed control system devices.
- B. The CONTRACTOR shall mark Specifications to indicate approved substitutions, Change

Orders, and actual equipment and materials used.

### 3.02 OPERATION AND MAINTENANCE DATA

Refer to Section 01705 (Project Closeout) for procedures and requirements for preparing and submitting operation and maintenance manuals.

A. The CONTRACTOR shall include the following information:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include:
  - a. Start-up, break-in, routine and normal operating instructions.
  - b. Regulation, control, stopping, shut-down, and emergency instructions.
  - c. Summer and winter operating instructions.
3. Maintenance procedures for:
  - a. Troubleshooting and routine preventative maintenance.
  - b. Disassembly, repair, and reassembly.
  - c. Aligning and adjusting.
4. Servicing instructions and lubrication charts and schedules.

### 3.03 WARRANTIES

- A. The CONTRACTOR shall compile and assemble the warranties into a separated set of vinyl covered, three-ring binders, tabulated and indexed for easy reference.
- B. The CONTRACTOR shall provide for all products and equipment used on the project, complete warranty information including:
  1. Date of beginning of warranty or bond.
  2. Duration of warranty or bond.
  3. Contact information (e.g., names, addresses, and telephone numbers) and procedures for filing a claim and obtaining warranty services.

**END OF SECTION 33 50 10**

## **SECTION 33 50 51 - MECHANICAL RELATED WORK**

### **PART 1 - GENERAL**

#### **1.01 RELATED DOCUMENTS**

Drawings and general provisions of Contract, including General and Special Conditions, apply to Work of this section.

#### **1.02 DESCRIPTION OF WORK**

- A. Extent of mechanical related work and work required by this section is indicated on drawings and/or specified in other sections of these Specifications.
- B. The CONTRACTOR shall furnish all labor, material, and equipment, and the CONTRACTOR shall perform all operations required to satisfactorily and properly install, adjust, test and place into operation all equipment and system shown on the construction Drawings.
- C. The CONTRACTOR shall submit submittal data and as-built drawings for each piece of equipment or installation.

#### **1.03 EQUIPMENT INSTALLATION**

- A. The CONTRACTOR shall install all equipment and systems shown on the Drawings and/or specified herein in a workmanlike manner and in strict accordance with the Manufacturer's recommendations.
- B. The CONTRACTOR shall furnish and connect all required piping, electrical connections, and other necessary items to provide a complete operating facility.

#### **1.04 EQUIPMENT TESTING AND ADJUSTING**

- A. The CONTRACTOR shall demonstrate that all equipment is operating in a satisfactory manner after installation.
- B. The CONTRACTOR shall lubricate all equipment according to vendors' recommendations and shall make all adjustments to suit anticipated operating conditions.
- C. The CONTRACTOR shall test each piece of equipment to show that it operates quietly, without vibration, overheating, or signs of distress, at full specified capacity.
- D. The CONTRACTOR shall make adjustments as necessary.
- E. The CONTRACTOR shall replace all defective parts of machinery, equipment, or materials.
- F. The CONTRACTOR shall secure and submit to the ENGINEER, vendor's certificates detailing that the installation of equipment is in accordance with the Manufacturer's recommendations.
- G. The CONTRACTOR shall submit to the ENGINEER five copies of all necessary manuals and instructions describing the proper operation and maintenance of each type of equipment furnished.

1.05 INSTALLATION SUPERVISION

- A. The CONTRACTOR shall install, initially start up, and operate all equipment shall under the supervision of a factory-trained technical representative of the Manufacturer.
- B. Manufacturer representative's services shall include instruction from the OWNER's operator in the operation, maintenance, and adjustment of the equipment.
- C. The CONTRACTOR shall give the ENGINEER and OWNER's operator 48 hours notice before start-up. Start-up shall not proceed without the presence of the ENGINEER.

1.06 EQUIPMENT REQUIREMENTS

The following requirements shall apply to equipment furnished in the Contracts:

- A. Each piece of mechanical equipment and motors shall be provided with a substantial nameplate of non-corrodible metal, securely fastened in place, clearly and permanently inscribed with the Manufacturer's name, model or type designation, serial number, rated capacity, electrical or other power characteristics, and other appropriate nameplate data.
- B. All equipment shall be delivered fully lubricated with oil and/or grease insofar as possible. If any point cannot be so serviced, it shall be clearly marked to the effect that it is not lubricated and requires servicing prior to operation. An adequate supply of the proper lubricant, with instructions for its application, shall be supplied with the equipment for each point not lubricated prior to shipment. The CONTRACTOR shall also provide the OWNER with a sufficient amount of proper lubricants for one complete change of lubricant for all equipment furnished.
- C. All factory-painted equipment shall be provided with 2 pints of touch up paint to match original finish along with instructions for application.

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION (Not Applicable)**

**END OF SECTION 33 50 51**