

Navarre Beach Parking and Restroom

Santa Rosa County, Florida

SPECIFICATIONS

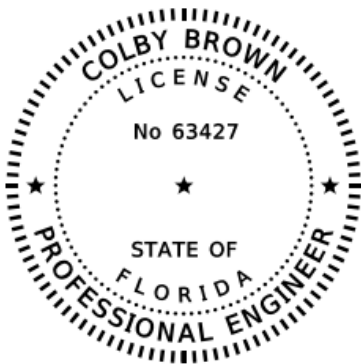
AUGUST 2025

Prepared by STOA Architects
STOA #24030

AND

Prepared by Dewberry Engineers
#50182809





THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY

Colby Brown

Digitally signed by Colby Brown
Reason: I agree to specified portions of
this document
Date: 2025.12.04 13:56:42-06'00'

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DEWBERRY ENGINEERS, INC.
316 S BAYLEN ST, SUITE 301
PENSACOLA, FLORIDA 32502
COLBY BROWN, P.E. NO. 63427

THE ABOVE NAMED PROFESSIONAL ENGINEER SHALL BE RESPONSIBLE FOR THE CIVIL-SITE
SUBGROUP IN ACCORDANCE WITH RULE 6G15-23.004, F.A.C.



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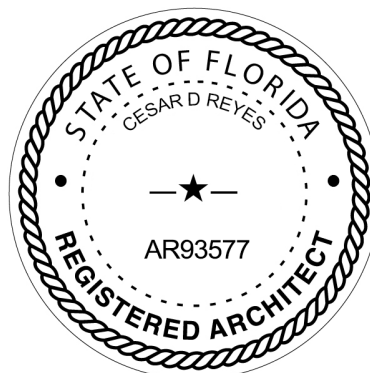
Kevin S. Brown

Digitally signed by Kevin S. Brown
DN: C=US, E=kbrown@legacy-collab.com, O="Legacy
Collaborative, LLC", CN=Kevin S. Brown
Reason: I agree to specified portions of this document
Date: 2025.12.11 13:27:16-06'00'

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LEGACY COLLABORATIVE, LLC
1800 INTERNATIONAL PARK DR, SUITE 210
BIRMINGHAM, ALABAMA 35243
KEVIN S. BROWN, P.E. NO. 70356



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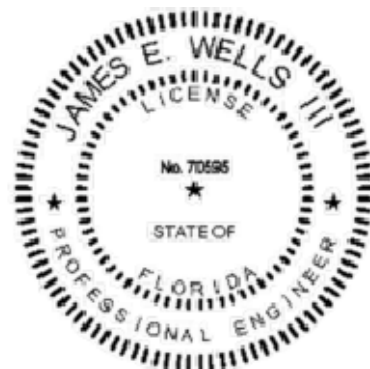
Cesar Reyes

Digitally signed by Cesar Reyes
DN: C=US,
E=creyes@stoaarchitects.com,
O=STOA Architects, CN=Cesar Reyes
Date: 2025.12.12 08:50:03-06'00'

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STOA ARCHITECTS
121 E GOVERNMENT ST
PENSACOLA, FLORIDA 32502
CESAR REYES, AR93577



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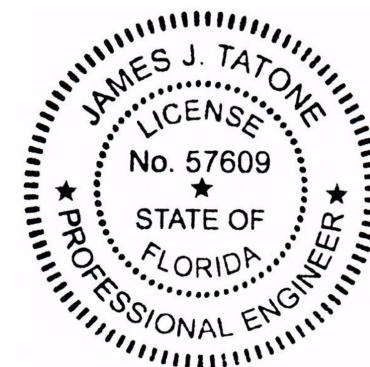
James E.
Wells III

Digitally signed by James E. Wells III
DN: CN=James E. Wells III, O=W3 Engineering
Inc, E=jay@w3engineeringinc.com, C=US
Reason: I am the author of this document
Location:
Date: 2025.12.11 08:46:43-06'00'
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W3 ENGINEERING INC.
110 E. WRIGHT ST.
PENSACOLA, FLORIDA 32501
JAMES E. WELLS, P.E. NO. 70595



THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY

James Tatone
2025.12.11
09:11:45-06'00'

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RUBY ENGINEERING INC.
3 W GARDEN ST, SUITE 414
PENSACOLA, FLORIDA 32502
JAMES J. TATONE, P.E. NO. 57609

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SECTION 01095
REFERENCE STANDARDS

PART 1 – GENERAL

1.01 REQUIREMENT

- A. Except as modified by these Contract Documents, or applicable codes which establish stricter standards, the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, Latest Edition, shall apply.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01300
SUBMITTALS

1.01 REQUIREMENTS INCLUDED

- A. The CONTRACTOR shall submit to the ENGINEER for review such working drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this Section called "Data"), and material samples (hereinafter in this Section called "Samples") as are required for the proper control of work, including but not limited to those working drawings, shop drawings, Data and Samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.
- B. The CONTRACTOR shall note that there are specific submittal requirements in other sections of these Specifications.
- C. The CONTRACTOR is to maintain an accurate updated submittal log and shall bring this log to each scheduled progress meeting with the PROJECT REPRESENTATIVE and the ENGINEER. This log shall be organized using the 10 character numbering system in Subparagraph 1.6 F. This log should include the following items:
 - 1. Submittal: Description and File Number assigned.
 - 2. Date to ENGINEER.
 - 3. Date returned to CONTRACTOR (from ENGINEER).
 - 4. Status of Submittal
 - a. Approved
 - b. Approved As Noted
 - c. Approved As Noted/Confirm
 - d. Not Approved/Resubmit
 - e. Not Approved
 - 5. Date of Resubmittal and Return (as applicable).
 - 6. Date material released (for fabrication).
 - 7. Projected date of fabrication.
 - 8. Projected date of delivery to site.
 - 9. Status of O&M submittal.

1.02 SHOP DRAWINGS

- A. When used in the Contract Documents, the term “shop drawings” shall be considered to mean CONTRACTOR’s plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop drawings shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer’s scale drawings, bills of material, wiring and control diagrams, and inspection and test reports including performance curves and certifications as applicable to the Work.
- B. All details on shop drawings submitted for approval shall show clearly the elevations of the various parts to the main members and lines of the structure and/or equipment, and where correct fabrication of the Work depends upon field measurements, such measurements shall be made and noted on the shop drawings before being submitted for approval.
- C. See Shop Drawing Schedule requirements in Subparagraph 1.7 CONTRACTOR’S RESPONSIBILITY.

1.03 PRODUCT DATA

Product data as specified in individual sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer’s product specification and installation instructions, availability of colors and patterns, MANUFACTURER’S printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing storage instructions, and printed product warranties, as applicable to the Work.

1.4 WORKING DRAWINGS

- A. When used in the Contract Documents, the term “working drawings” shall be considered to mean the CONTRACTOR’s plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, ground water control systems, forming and false work; for underpinning; and for such other work as may be required for construction but does not become an integral part of the Project.
- B. Working drawings shall be signed and sealed by a registered Professional Engineer, currently licensed to practice in the State and shall convey, or be accompanied by, calculations or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use.

- C. Prior to commencing such Work, working drawings must have been reviewed without specific exceptions by the ENGINEER. Such review will be for general conformance and will not relieve the CONTRACTOR in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the CONTRACTOR; the OWNER and ENGINEER shall have no responsibility therefore.

1.05 SAMPLES

- A. The CONTRACTOR shall furnish, for the approval of the ENGINEER, samples required by the Contract Documents or requested by the ENGINEER. Samples shall be delivered to the ENGINEER as specified or requested and in quantities and sizes as specified. A minimum of two samples of each item shall be submitted unless otherwise specified. The CONTRACTOR shall pre-pay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in the Work until approved by the ENGINEER.
- B. Samples specified in individual sections, include, but are not necessarily limited to, physical examples of the Work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of Work to be used by the ENGINEER or PROJECT REPRESENTATIVE for independent inspection and testing, as applicable to the Work.
- C. The CONTRACTOR shall prepare a transmittal letter in triplicate for each shipment of samples to the ENGINEER. The CONTRACTOR shall enclose a copy of this letter with the shipment and send a copy of this letter to the PROJECT REPRESENTATIVE. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.
- D. Approved samples not destroyed in testing shall be sent to the ENGINEER or stored at the site of the Work. Materials and equipment incorporated in the Work shall match the approved samples. Samples which fail testing or are not approved will be returned to the CONTRACTOR at their expense, if so requested at time of submission.

1.06 SUBMITTAL REQUIREMENTS

- A. The CONTRACTOR shall review, approve, and submit, with reasonable promptness and in such sequence as shown on the Shop Drawing Submittal Schedule so as to cause no delay in the Contract Work or in the Work of the OWNER or any separate contractor, all shop drawings, product data, working drawings and samples required by the Contract Documents.

- B. The CONTRACTOR shall submit 10 copies of all shop drawings for the ENGINEER to review, of which the ENGINEER will retain eight sets.
- C. All submittals shall be directly transmitted to the ENGINEER's office. Submittals to the PROJECT REPRESENTATIVE will not be accepted.
- D. Shop drawings, product data, working drawings and Samples shall be furnished with the following information:
 - 1. Number and title of the drawing.
 - 2. Date of drawing or revision.
 - 3. Name of project building or facility.
 - 4. Name of contractor, subcontractor, and manufacturer submitting drawing.
 - 5. Clear identification of contents, location of the work, and the sheet numbers where the product is found in the contract drawings.
 - 6. CONTRACTOR Certification Statement.
 - 7. Submittal Identification Number.
 - 8. Contract Drawing Number Reference.
 - 9. A certification by the CONTRACTOR that states the following: I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is in compliance with the Contract Drawings and Specifications, can be installed in the allocated space, will be stored in accordance with the manufacturers recommendations and the Specifications, and is submitted for approval.
- E. In accordance with Subparagraph 1.7 A, each shop drawing, working drawing, Sample, and catalog data submitted by the CONTRACTOR shall have affixed to it the following Certification Statement, signed by the CONTRACTOR: "Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers, and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all contractor requirements."

- F. The CONTRACTOR shall utilize a 10-character submittal identification numbering system in the following manner:
1. The first character shall be a D, S, P, M, or R, which represents Shop/Working Drawing and other Product Data (D), Sample (S), Preliminary Submittal (P), Operating/Maintenance Manual (M), or Request for Information (R).
 2. The next five digits shall be the applicable Specification Section Number.
 3. The next three digits shall be the numbers 001-999 to sequentially number each item or drawing submitted under each specific Section number.
 4. The last character shall be a number 1-10, indicating the submission, or resubmission of the same Drawing, i.e., 1=1st submission, 2=2nd submission, 3=3rd submission, etc. A typical submittal number would be as follows:

D-03300-008.2	
D	= Shop Drawing
03300	= Specification Section for Concrete
008	= The eighth submittal under this specification section
2	= The second submission (first resubmission) of that particular shop drawing.
- G. The CONTRACTOR shall submit a copy of each submittal transmittal sheet (for shop drawings, product data, working drawings and Samples) to the PROJECT REPRESENTATIVE simultaneously with the CONTRACTOR's submission of said drawings, Data, Samples or manual packages to the ENGINEER.
- H. All items specified are not necessarily intended to be a manufacturer's standard product. Variations from specified items will be considered on an "or equal" basis. If submittals show variations from Contract requirements because of standard shop practice or for other reasons, the CONTRACTOR shall describe such variations in the letter of transmittal and on the shop drawings along with notification of intent to seek contract adjustment. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the CONTRACTOR fails to describe such variations, responsibility will not be waived for executing the Work in accordance with the Contract, even though such drawings have been reviewed. Variations submitted but not described may be cause for rejection. Any variations initiated by the CONTRACTOR will not be considered as an addition to the scope of work unless specifically noted and then approved as such in writing by the ENGINEER.

- I. Data on materials and equipment shall include materials and equipment lists giving, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, material, size, finish, and all other pertinent data.
- J. For all mechanical and electrical equipment furnished, the CONTRACTOR shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and Service Company so that service and/or spare parts can be readily obtained. In addition, a maintenance and lubrication schedule for each piece of equipment shall be submitted.
- K. The CONTRACTOR shall use the color "green" to make his remarks on the Submittals. Only the ENGINEER will utilize the color "red" in marking submittals.
- L. Facsimiles or copies of facsimiles will not be accepted for review.

1.07 CONTRACTOR'S RESPONSIBILITY

- A. It is the duty of the CONTRACTOR to check, and coordinate with the work of all trades, all drawings, Data, schedules and Samples before submitting them to the ENGINEER for review. Each and every copy of any drawing or data sheet larger than 11"x17" shall bear CONTRACTOR's stamp showing that they have been so checked and approved. Drawings or data sheets 11"x17" and smaller shall be bound together in an orderly fashion and bear the CONTRACTOR's stamp on the cover sheet. The cover sheet shall fully describe the packaged data and include a list of all sheet numbers within the package. Shop drawings submitted to the ENGINEER without the CONTRACTOR's stamp will be returned to the CONTRACTOR, without review at the ENGINEER's option, for conformance with this requirement.
- B. The CONTRACTOR shall review shop drawings, product data, and Samples prior to submission to determine and verify the following:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Manufacturer's catalog numbers and similar data.
 - 4. Conformance with Specifications.
- C. Shop drawings shall indicate any deviations in the submittal from the requirements of the Contract Documents.

- D. At a time decided upon at the preconstruction meeting the CONTRACTOR shall furnish the PROJECT REPRESENTATIVE and ENGINEER a Shop Drawing schedule fixing the respective dates for the initial submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall be provided as a separate entity and indicate those submittals that are critical to the progress schedule. The CONTRACTOR shall prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery, and similar sequenced activities. No extension of time will be authorized because of the CONTRACTOR's failure to transmit complete and acceptable submittals sufficiently in advance of the Work.
- E. The CONTRACTOR shall not begin any Work affected by a submittal returned not approved. Before starting this Work, all revisions must be corrected by the CONTRACTOR. After resubmittal they will be reviewed and returned by the ENGINEER. If approved or approved as noted, then the CONTRACTOR may begin this Work. Any corrections made to the shop drawings are to be followed without exception.
- F. The CONTRACTOR shall submit to the ENGINEER all shop drawings and data sufficiently in advance of construction requirements to provide no less than **21** calendar days for review from the time the ENGINEER receives them. No less than **30** calendar days will be required for major equipment that requires review by more than one engineering discipline.
- G. The CONTRACTOR shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of Work prior to the review and approval by ENGINEER of the necessary shop drawings.
- H. All shop drawings, product data, working drawings and Samples submitted by subcontractors for approval shall be sent directly to the CONTRACTOR for checking. The CONTRACTOR shall be responsible for their submission according to the approved shop drawing schedule so as to prevent delays in delivery of materials and project completion.
- I. The CONTRACTOR shall check all subcontractors' shop drawings, product data, working drawings and Samples regarding measurements, size of members, materials, and details to satisfy himself that they are in conformance to the Contract Documents. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission to the ENGINEER.

- J. Requests for Information (RFI) shall be submitted on a standard form through the PROJECT REPRESENTATIVE. RFIs shall indicate their importance to the timely completion of the project. RFIs will be processed as a shop drawing unless there is an urgent need for immediate response.

1.08 ENGINEER'S REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

- A. The ENGINEER's review is for general conformance with the design concept and contract drawings. Markings or comments shall not be construed as relieving the CONTRACTOR from compliance with the contract plans and specifications or from departures therefrom. The CONTRACTOR remains responsible for details and accuracy, for coordinating the Work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- B. The review of shop drawings, Data, and Samples will be general. They shall not be construed:
 - 1. as permitting any departure from the Contract requirements;
 - 2. as relieving the CONTRACTOR of responsibility for any errors, including details, dimensions, and materials;
 - 3. as approving departures from details furnished by the ENGINEER, except as otherwise provided herein.
- C. If the shop drawings, Data or Samples as submitted describe variations per Subparagraph (1.6H), and show a departure from the Contract requirements which ENGINEER finds to be in the interest of the OWNER and to be so minor as not to involve a change in Contract Price or Contract Time for performance, the ENGINEER may return the reviewed drawings without noting an exception.
- D. Submittals will be returned to the CONTRACTOR under one of the following codes:
 - Code 1 - "APPROVED"** is assigned when there are no notations or comments on the submittal. When returned under this code the CONTRACTOR may release the equipment and/or material for manufacture.
 - Code 2 - "APPROVED AS NOTED"** is assigned when notations or comments have been made on the submittal pointing out minor discrepancies as compared with the Contract Documents. Resubmittal or confirmation is not necessary prior to release for manufacturing.

Code 3 - “APPROVED AS NOTED/CONFIRM” This combination of codes is assigned when a confirmation of the notations and comments is required by the CONTRACTOR. The CONTRACTOR may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation is to address the omissions and/or nonconforming items that were noted. Only the items to be “confirmed” need to be resubmitted.

Code 4 - “NOT APPROVED/RESUBMIT” This combination of codes is assigned when the submittal is in noncompliance with the Contract Documents and must be corrected and the entire package resubmitted. This code generally means that the equipment or material cannot be released for manufacture unless the CONTRACTOR takes full responsibility for providing the submitted items in accordance with Contract Documents.

Code 5 - “NOT APPROVED” is assigned when the submittal does not meet the intent of the Contract Documents. The CONTRACTOR must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.

Code 6 - “COMMENTS ATTACHED” is assigned where there are comments attached to the returned submittal which provide additional data to aid the CONTRACTOR.

Code 7 - “FOR YOUR INFORMATION” is assigned when the package provides information of a general nature that may or may not require a response.

Codes 1 through 5 designate the status of the reviewed submittal with Code 6 showing there has been an attachment of additional data.

Code 7 is used as may be necessary.

- E. Resubmittals will be handled in the same manner as first submittals. On resubmittals the CONTRACTOR shall direct specific attention, in writing on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the ENGINEER on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the CONTRACTOR. The CONTRACTOR shall make corrections to any Work done because of this type revision that is not in accordance to the Contract Documents as may be required by the ENGINEER.

- F. If the CONTRACTOR considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the CONTRACTOR shall give written notice thereof to the PROJECT REPRESENTATIVE at least 7 working days prior to release for manufacture.
- G. The ENGINEER will review a submittal a maximum of two times, after which cost of review will be borne by the CONTRACTOR. The cost of engineering shall be equal to the ENGINEER's charges to the OWNER under the terms of the ENGINEER's agreement with the OWNER.
- H. When the shop drawings have been completed to the satisfaction of the ENGINEER, the CONTRACTOR shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the ENGINEER.
- I. Partial submittals may not be reviewed. The ENGINEER will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the CONTRACTOR, and will be considered "Not Approved" until resubmitted. The ENGINEER may, but is not required to, provide a list or mark the submittal directing the CONTRACTOR to the areas that are incomplete

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

**SECTION 01360
MEASUREMENT AND PAYMENT**

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. The scope of this section of the Contract Documents is to further define the items included in each Bid Item in the Bid Proposal section of these Specifications.
- B. Payment will be made based on the specified items included in the description in this section for each Bid Item.

1.02 GENERAL

- A. All Contract Prices included in the Bid Proposal section will be full compensation for all labor, materials, tools, equipment and incidentals necessary to complete the construction as shown on the drawings and/or as specified in the Contract Documents to be performed under this contract.
- B. Actual quantities of each item bid on a unit price basis will be determined upon completion of the construction in the manner set up for each item in this section of the specifications.
- C. Payment for all items listed in the Bid Form will constitute full compensation for all work shown and/or specified to be performed under this Project.

1.03 WORK OUTSIDE AUTHORIZED LIMITS

- A. No payment will be made for work constructed outside the authorized limits of work.

1.04 LUMP SUM ITEMS

- A. Where payment for items is shown to be paid for on a lump sum basis, no separate payment will be made for any item of work required to complete the lump sum item.
- B. Lump sum bid items shall be complete, tested, and fully operable prior to request for final payment.
- C. The lump sum price bid for various items shall be compensation in full for furnishing all materials, labor, equipment, dewatering, and incidentals necessary to install these items complete and operable in every detail and in accordance with the Drawings and Specifications.

1.05 OTHER PROVISIONS

- A. No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of Work.
 - 1. Reduction in retainage shall not be requested by the CONTRACTOR or made by the OWNER until as-built (record) drawings have been submitted to the ENGINEER and approved.
 - 2. Trench excavation, including necessary pavement removal, rock removal, and muck removal.
 - 3. Sheet piling and shoring.
 - 4. Clearing, grubbing, and grading.
 - 5. Erosion Control.
 - 6. Excavation, including necessary pavement removal, rock removal, and muck removal.
 - 7. Dewatering and disposal of surplus water.
 - 8. Structural fill, backfill, and grading.
 - 9. Placing system in operation.
 - 10. Any material and equipment required to be installed and utilized for tests.
 - 11. Maintaining the existing quality of service during construction.
 - 12. Appurtenant work as required for a complete and operable system.
 - 13. By-pass pumping.
 - 14. Maintenance of Traffic.

1.06 APPLICATION FOR PAYMENT

- A. The CONTRACTOR shall submit an application for payment, no more frequent than monthly, to the ENGINEER for review and approval upon partial completion of the project before the CONTRACTOR will be compensated for the Work performed during that period.
- B. The application shall invoice work completed as detailed in the CONTRACTOR's Proposal.

- C. Final payment in full will be made when Work is completed to the satisfaction of the OWNER, and the ENGINEER, when it has been shown that the CONTRACTOR has discharged all obligations of this Contract (Release of Liens) and when all punch list items have been corrected.
- D. Application for payment will be made on the standard AIA form, or type of form approved by the OWNER.

PART 2 - (NOT APPLICABLE)

PART 3 – EXECUTION - MARIANNA SEWER REHABILITATION

3.1 BID ITEM 1.1 – MOBILIZATION

- A. Payment for all work included under this Bid Item will be made at the lump sum price bid for mobilization of all labor, equipment, materials, and appurtenances necessary for construction of the Project.
- B. Mobilization shall include all items detailed in Article 101-1 of the FDOT Standard Specification.
- C. Also included, but not limited to, as part of this Bid Item is the cost for project performance indemnification's, photographs, videography (except as noted), shop drawings, working drawings, schedules, record drawings and documents, coordination and phasing, and other miscellaneous items associated with the work.
- D. Payment will be lump sum for work included under this Bid Item. Sixty percent of the lump sum amount will be payable upon mobilization.
- E. The remaining 40% will be payable upon demobilization.
- F. THIS BID ITEM SHALL BE LESS THAN OR EQUAL TO 3% OF THE BASE BID AMOUNT.

3.2 BID ITEM 1.2 – BONDS AND INSURANCE

- A. Payment for this Bid Item will be made at the lump sum price bid for all bonds and insurance policies as required by the Contract Documents.
- B. Payment will be made only after proper documentation is provided to the ENGINEER. Payment will be lump sum for work included under this Bid Item.
- C. THIS BID ITEM SHALL BE LESS THAN OR EQUAL TO 1.5% OF THE BASE BID AMOUNT.

3.3 BID ITEM 1.3 – PROJECT SIGN

- A. The lump sum price for the project sign includes all material, labor, equipment, and incidentals necessary to construct a sign as shown in specifications.
- B. The location of the sign will be coordinated with the OWNER.

3.4 BID ITEM 2.1, 2.2, 2.3, 2.4 & 2.5 – CURED-IN-PLACE PIPE REHABILITATION

- A. The unit price for these bid items shall include, but is not limited to, all labor, material, equipment, and supplies incidental to supplying and installing a cured-in-place liner into the gravity sewer lines as shown in the Drawings and according to the Specifications.
- B. The unit price for these bid items shall also include the re-connection to all existing sewer service laterals and manholes.
- C. These bid items shall include, but is not limited to, any required cleaning of sewer lines, bypass pumping, pre/post construction video inspection, sewer line obstruction removal, public notifications, maintenance of traffic, and use of a vacuum truck.
- D. The unit price for these bid items shall also include the video documentation of the gravity sewer pipe system before and after the construction, respectively. The preconstruction video and video report must be submitted to and approved by the OWNER before rehabilitation on that segment of sewer line may commence. The post construction video and video report must be submitted to and approved by the OWNER before payment under this bid item will be made.
- E. Payment for this bid item shall be made per linear foot of completed, inspected, video documented, and approved rehabilitated pipe.

3.5 BID ITEM 2.6 – MANHOLE REHABILITATION

- A. The unit price for this bid item shall include, but is not limited to, all labor, material, equipment, and supplies incidental to supplying and installing either the PolyTriplex, SpectraShield, PerpetuWall or approved equal manhole rehabilitation as shown in the Drawings and according to the Specifications.
- B. This bid item shall include, but is not limited to, any required cleaning, bypass pumping, public notifications, maintenance of traffic, and use of a vacuum truck.
- C. Payment for this bid item shall be made per vertical foot of completed, inspected, and approved rehabilitated manhole.

3.6 BID ITEM 2.7 – LATERAL REHABILITATION

- A. This bid item includes the unit costs associated with the rehabilitation of all 4-inch and 6-inch service connections/laterals that connect to the gravity sewer collection pipes to be rehabilitated as shown on the Drawings.
- B. Rehabilitation will extend from the gravity sewer collection pipe to within 5 feet of the existing clean out or right of way, whichever is closer to the sewer pipe.
- C. This bid items shall include, but is not limited to, any required cleanout installations, access pits, lateral cleaning, bypass pumping, pre/post construction video inspection, obstruction removal, public notifications, maintenance of traffic, and vacuum.
- D. The unit price for these bid items shall also include the video documentation of the sewer service lateral before and after the construction, respectively. The post construction video and video report must be submitted to and approved by the OWNER before payment under this bid item will be made.
- E. Payment for this item will be made per rehabilitated, inspected, and approved lateral.

3.7 BID ITEM 3.1, 3.2, 3.3, 3.4 & 3.5 – GRAVITY SEWER POINT REPAIR

- A. The unit price for these bid items shall include all labor, material, equipment, and other necessary costs and incidentals associated with 6-inch, 8-inch, 10-inch , 12-inch or 15-inch gravity sewer pipe point repairs.
- B. Point repairs are limited to repairs to pipe less than 10 feet in length due to items including but no limited to pipe sags, pipe breaks, or pipe offsets.
- C. This bid item shall include excavation, right-of-way restoration and pavement replacement per construction plan details and specifications. This bid item shall not include sidewalks, curbs, and gutters replacement cost.
- D. This bid item shall include any costs associated with the NPDES permit, maintenance of traffic, dewatering and use of a vacuum truck.
- E. This bid items shall include, but is not limited to, any required asphalt, road base, stabilized subgrade, standard pipeline bedding and earthwork.
- F. All gravity sewer pipe point repairs shall be approved in writing by the Owner's representative prior to the commencement of work and shall be considered as a separate pay item.

- G. Payment will be made per installed, inspected, and approved gravity sewer pipe point repairs.

3.8 BID ITEM 3.6 – CLEAN OUT INSTALLATION

- A. The unit price for this bid item includes all labor, material, equipment, and other necessary costs and incidentals associated with a sewer lateral clean out installation.
- B. This bid item shall include any costs associated with the NPDES permit, maintenance of traffic, dewatering and use of a vacuum truck.
- C. This bid item shall include excavation and minimal right-of-way restoration. This bid item shall not include pavement replacement, sidewalks, curbs, and gutters replacement.
- D. All clean out installations shall be approved in writing by the Owner's representative prior to the commencement of work and shall be considered as a separate pay item.
- E. Payment will be made per installed, inspected, and approved clean out installation.

3.9 BID ITEM 3.7– LATERAL REPLACEMENT

- A. This bid item includes the unit costs associated with the replacement of 4-inch and 6-inch service connections/laterals that connect to the gravity sewer collection pipes to be rehabilitated as shown on the Drawings.
- B. Replacement will extend from the gravity sewer collection pipe to the existing clean out or right of way, whichever is closer to the sewer pipe.
- C. This bid item shall include excavation, connection to the sewer pipe, connection to the existing lateral, right-of-way restoration and pavement replacement per construction plan details and specifications. This bid item shall not include sidewalks, curbs, and gutters replacement cost.
- D. This bid item shall include any costs associated with the NPDES permit, maintenance of traffic, dewatering and use of a vacuum truck.
- E. This bid items shall include, but is not limited to, any required asphalt, road base, stabilized subgrade, standard pipeline bedding and earthwork.
- F. All sewer lateral replacements shall be approved in writing by the Owner's representative prior to the commencement of work and shall be considered as a

separate pay item.

- G. Payment will be made per installed, inspected, and approved lateral replacement.

3.10 BID ITEM 4.1& 4.2 – HEAVY PIPELINE CLEANING

- A. The unit price for this bid item includes the cleaning of 6-inch, 8-inch, 10-inch , 12-inch or 15-inch pipeline that contains sand and grease filling more than 25% of the pipe area.
- B. This bid items shall include, but is not limited to, any required bypass pumping, public notifications, maintenance of traffic, and use of vacuum truck.
- C. The OWNER will provide water and the dump site.
- D. All heavy sewer pipe cleaning shall be approved in writing by the Owner's representative prior to the commencement of work and shall be considered as a separate pay item.
- E. Payment for this item will be made per linear foot of cleaned pipe.

3.11 BID ITEM 4.3 – PIPELINE OBSTRUCTION REMOVAL

- A. The unit price for this bid item includes all material, labor, equipment and other appurtenances associated with removing any Major Obstructions from the gravity sewer pipes.
- B. Major Obstructions shall be defined as an obstruction that cannot be removed by conventional sewer cleaning equipment.
- C. All sewer pipe obstruction removals shall be approved in writing by the Owner's representative prior to the commencement of work and shall be considered as a separate pay item.
- D. Payment will be made per documented and approved obstruction removal.

3.12 BID ITEM 4.4 – BYPASS PUMPING

- A. The unit price for this bid item shall include all material, labor, equipment and other appurtenances associated with bypass pumping for 4 hours at a maximum of 700 feet from one manhole to a discharge point.
- B. This amount shall be deducted from unit price items where bypass pumping is not

used or not required as determined by the ENGINEER.

3.13 ALTERNATE ITEMS A1 THRU A9 – PIPELINE REPLACEMENT

- A. The unit price for these alternative bid items shall include all labor, material, equipment, and other necessary costs and incidentals associated with the replacement of 8-inch, 10-inch , 12-inch or 15-inch gravity sewer pipe.
- B. This bid item shall include excavation and right-of-way restoration per construction plan details and specifications. This bid item shall not include pavement replacement, sidewalks, curbs, and gutters replacement cost.
- C. This bid item shall include any costs associated with the NPDES permit, maintenance of traffic, dewatering and use of a vacuum truck.
- D. This bid items shall include, but is not limited to, any required stabilized subgrade, standard pipeline bedding and earthwork.
- E. All gravity sewer pipe replacements shall be approved in writing by the Owner's representative prior to the commencement of work and shall be considered as a separate pay item.
- F. Payment will be made per linear foot of installed, inspected, and approved gravity sewer pipe.

3.14 ALTERNATE ITEM A10 – SEWER LATERAL INSTALLATION

- A. This bid item includes the unit costs associated with the installation of 4-inch and 6-inch service connections/laterals that connect to new gravity sewer collection pipes that were approved to be replaced by the Owner.
- B. Installation will extend from the new gravity sewer collection pipe to the existing clean out or right of way, whichever is closer to the sewer pipe.
- C. This bid item shall include excavation, connection to the new sewer pipe, connection to the existing lateral and right-of-way restoration per construction plan details and specifications. This bid item shall not include pavement replacement, sidewalks, curbs, and gutters replacement cost.
- D. This bid item shall include any costs associated with the NPDES permit, maintenance of traffic, dewatering and use of a vacuum truck.
- E. This bid items shall include, but is not limited to, any required stabilized

subgrade, standard pipeline bedding and earthwork.

- F. All sewer lateral installations shall be approved in writing by the Owner's representative prior to the commencement of work and shall be considered as a separate pay item.
- G. Payment will be made per installed, inspected, and approved lateral installation.

3.15 ALTERNATE ITEM A11 – MANHOLE REPLACEMENT

- A. The unit price for this alternative bid item shall include all labor, material, equipment, and other necessary costs and incidentals associated with the replacement of manholes at the depth listed.
- B. This bid item shall include excavation, connection to the gravity sewer pipes, and right-of-way restoration per construction plan details and specifications. This bid item shall not include pavement replacement, sidewalks, curbs, and gutters replacement cost.
- C. This bid item shall include any costs associated with the NPDES permit, maintenance of traffic, dewatering and use of a vacuum truck.
- D. This bid items shall include, but is not limited to, any required stabilized subgrade, standard pipeline bedding and earthwork.
- E. All manhole replacements shall be approved in writing by the Owner's representative prior to the commencement of work and shall be considered as a separate pay item.
- F. Payment will be made per installed, inspected, and approved manhole replacement.

3.16 ALTERNATE ITEMS A12, A13 & A14 – ROADWAY REPAIR

- A. The unit price for this item shall include all the additional labor, material, equipment, and appurtenances required for roadway repairs associated with the replacement of gravity sewer pipe and manhole replacements.
- B. This bid item shall include excavation and asphalt pavement replacement per construction plan details and specifications. This bid item shall not include sidewalks, curbs, and gutters replacement cost.
- C. This bid item shall include any costs associated with the NPDES permit and maintenance of traffic.
- D. This bid items shall include, but is not limited to, any required asphalt or other roadway surface, road base, stabilized subgrade, and earthwork.

- E. All roadway repairs shall be approved in writing by the Owner's representative prior to the commencement of work and shall be considered as a separate pay item.
- F. Payment will be made per square yard of installed, inspected, and approved roadway repair.

END OF SECTION

**SECTION 01380
CONSTRUCTION PHOTOGRAPHS**

1.01 REQUIREMENTS

The CONTRACTOR shall take construction record photographs or video, including providing all labor, materials, equipment and incidentals necessary to obtain specified photographs and/or video tapes.

1.02 PROJECT PHOTOGRAPHS

- A. Provide photographs of the entire work area prior to any construction for the purpose of records of conditions prior to construction. Photographs should be spaced at approximately 100-foot intervals. In addition, all special features shall be photographed prior to construction.
- B. Photographs shall be submitted electronically each month with Request for Payment. A minimum of 10 photographs will be required each month for processing of Request of Payment.
- C. All project photographs shall be taken from locations to adequately illustrate conditions prior to construction, or conditions of construction and state of progress or particular construction activities or problems. The CONTRACTOR shall consult with the PROJECT REPRESENTATIVE for instructions concerning views required.
- D. The CONTRACTOR shall provide photos of the sites of the proposed ditch crossings and jack and bore crossings prior to the beginning of construction. Views shall be as required by the PROJECT REPRESENTATIVE.
- E. The CONTRACTOR shall deliver prints electronically in conformance with the above requirements to the PROJECT REPRESENTATIVE. No construction shall start until pre-construction photographs are completed and submitted to the PROJECT REPRESENTATIVE.

1.03 VIDEO RECORDINGS

- A. Video recording shall be accomplished along all routes that are scheduled for Construction in addition to required construction photos. Video shall include both sides of all streets on which construction is to be performed.
- B. A complete view, in sufficient detail, of all existing facilities with audio description of the exact location shall be provided.
- C. The construction plans shall be used as a reference for stationing for easy location identifications. If visible, house or business numbers shall be mentioned on the audio.

- D. Video shall be electronically delivered to the PROJECT REPRESENTATIVE for the permanent and exclusive use of the PROJECT REPRESENTATIVE prior to the start of any construction on the project.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

**SECTION 01505
MOBILIZATION/DEMOBILIZATION**

PART 1 - GENERAL

1.01 DEFINITION AND SCOPE

As required for the proper performance and completion of the Work, mobilization shall include, but not be limited to, the following principal items:

- A. Move onto the site all CONTRACTOR's plant and equipment required for the first month's operation.
- B. Install temporary construction power, wiring, telephone, and lighting facilities.
- C. Establish a fire protection plan and safety program.
- D. Secure construction water supply.
- E. Provide field office trailers for CONTRACTOR and PROJECT REPRESENTATIVE.
- F. Provide on-site sanitary facilities and potable water facilities.
- G. Arrange for and erect CONTRACTOR'S lay down and storage yard and employee's parking facilities.
- H. Submit all required insurance certificates and bonds.
- I. Obtain all required permits.
- J. Post all OSHA, FDEP, Department of Labor, and all other required notices.
- K. Have CONTRACTOR'S project manager and/or superintendent at the job site full time.
- L. Submit a detailed construction schedule acceptable to the PROJECT REPRESENTATIVE.
- M. Submit a Schedule of Values of the Work in an approved format acceptable to the PROJECT REPRESENTATIVE.
- N. Submit a hurricane preparedness plan acceptable to the PROJECT REPRESENTATIVE.
- O. Erect all required Project signs.

1.02 PAYMENT FOR MOBILIZATION

Payment for all mobilization/demobilization work will be made at the lump sum price bid for mobilization and demobilization of all labor, equipment, materials and appurtenances necessary for construction of the project. Mobilization shall include all items listed in the above paragraph. Also included, but not limited to, as part of this bid item is the cost for project performance indemnification's, shop drawings, working drawings, schedules, record drawings and documents, coordination, and phasing and other miscellaneous items associated with the work. Measurement and payment for this bid item will be lump sum. The lump sum price for mobilization/demobilization will be limited to 5.0 percent of the total contract amount. Eighty percent (80%) of the lump sum amount will be payable upon mobilization. The remaining 20% will be payable upon demobilization.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

**SECTION 01705
PROJECT CLOSEOUT**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this section.

1.02 DESCRIPTION OF REQUIREMENTS

Definitions:

- A. Closeout is hereby defined to include general requirements near the end of Contract Time, in preparation for final acceptance, final payment, normal termination of Contract, and similar actions evidencing completion of the Work. Specific requirements for individual units of work are specified elsewhere in these Specifications.
- B. Time of closeout is directly related to "Substantial Completion," and therefore; may be either a single time period for entire Work or a series of time periods for individual parts of the Work which have been certified as substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section.

1.03 PREREQUISITES FOR SUBSTANTIAL COMPLETION

- A. General:

Prior to requesting ENGINEER's inspection for certification of Substantial Completion (for either entire work or portions thereof), complete the following and list known exceptions in request:

1. In progress payment request, coincident with or first following date claimed, show either 100% completion for portion of Work claimed as "substantially complete" or list incomplete items, value of incompleteness, and reasons for being incomplete.
2. Include supporting documentation for completion as indicated in these Contract Documents.
3. Submit statement showing accounting of changes to the Contract Sum.

4. Advise OWNER of pending insurance change-over requirements.
5. Submit special warranties, workmanship/maintenance bonds, maintenance agreements, final certifications, and similar documents.
6. Obtain and submit releases enabling OWNER's full and unrestricted use of the work and access to services and utilities, including (where required) operating certificate, and similar releases.
7. Submit record drawings, maintenance manuals, and similar final record information.
8. Deliver tools, spare parts, extra stocks of materials, and similar physical items to the OWNER.
9. Make final change-over of locks and transmit keys to OWNER, and advise OWNER's personnel to change-over in security provisions, applicable.
10. Complete start-up testing of systems, and instructions of OWNER's operating/maintenance personnel. Discontinue (or change over) and remove from Project site temporary facilities and services, along with construction tools and facilities, mock-ups, and similar elements.
11. Complete final cleaning up requirements, including touch-up painting of marred surfaces.

B. Inspection Procedures:

Upon receipt of CONTRACTOR's request, the ENGINEER will either proceed with inspection or advise CONTRACTOR of prerequisites not fulfilled. Following initial inspection, the ENGINEER will either prepare certificate of Substantial Completion, or advise the CONTRACTOR of work which must be performed prior to issuance of certificate; and repeat inspection when requested and assured that work has been substantially completed. Results of completed inspection will form initial "punch-list" for final acceptance.

1.04 PREREQUISITES FOR FINAL ACCEPTANCE

A. General:

Prior to requesting ENGINEER's final inspection for certification of final acceptance and final payment, as required by General Conditions (Section 00100), complete the following and list known exceptions (if any) in request:

1. Submit final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit updated final statement, accounting for additional (final) changes to the Contract Sum.
3. Submit consent of surety.
4. Submit final liquidation damages settlement statement, acceptable to the OWNER.
5. Revise and submit evidence of final continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure:

Upon receipt of CONTRACTOR's notice that the work has been completed, including punch-list items resulting from earlier inspections, and excepting incomplete items delayed because of acceptable circumstances, the ENGINEER will reinspect the Work. Upon completion of reinspection, the ENGINEER will either prepare a certificate of final acceptance or advise the CONTRACTOR of Work not completed or obligations not fulfilled as required for final acceptance. If necessary, procedure will be repeated.

1.05 RECORD DOCUMENT SUBMITTALS

A. General:

Specific requirements for record documents are indicated in individual sections of these specifications. Other requirements are indicated in General Conditions. General submittal requirements are indicated in Section 01300 (Submittals).

Do not use record documents for construction purposes; protect from deterioration and loss in a secure fire-resistive location; provide access to record documents for ENGINEER's reference during normal working hours.

B. Record Drawings:

1. Maintain a set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown.
2. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings.

3. Mark with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work.
 4. Mark-up new information which is recognized to be of importance to the OWNER, but was for some reason not shown on either the Drawings or Shop Drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date.
 5. Note related Change Order numbers where applicable.
- C. Record Specifications:
1. Maintain one copy of specifications, including Addenda, Change Orders and similar modifications issued in printed form during construction, and mark-up variation (of substance) in actual work in comparison with text of Specifications and modifications as issued.
 2. Give particular attention to substitutions, selection of options, and similar information on Work where it is concealed or cannot otherwise be readily discerned at a latter date by direct observation.
 3. Note related Record Drawing information and product data, where applicable. Upon completion of mark-up, submit to ENGINEER for OWNER's records.
- D. Maintenance Manuals:
1. Organize maintenance-and-operating manual information into suitable sets of manageable size, and bind into individual binders properly identified and indexed (thumb tabbed). Four sets will be required.
 2. Include emergency instructions, spare parts listing, warranties' copies, wiring diagrams, recommended "turn-around" cycles, inspection procedures, shop drawings, product data, and similar applicable information.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 CLOSEOUT PROCEDURES

- A. General Operating/Maintenance Instructions:
1. Arrange for each installer of work requiring continuing maintenance or operating to meet with OWNER's personnel, at Project site, to provide basic instructions needed for proper operation and maintenance of entire Work.

2. Include instructions by manufacturer's representatives where installers are not expert in the required procedures.
3. Review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, fuels, identification systems, control sequences, hazards, cleaning, and similar procedures and facilities.
4. Demonstrate start-up, shut-down, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, energy effectiveness, and similar operations for operational equipment.
5. Review maintenance and operations in relation with applicable warranties, agreements to maintain, bonds, and similar continuing commitments.

3.02 FINAL CLEANING

A. General:

Special cleaning for specific units of work is specified in other sections. The following are examples, but not by way of limitation, of cleaning levels required:

1. Remove labels which are not required as permanent labels.
2. Wipe surfaces of mechanical and electrical equipment clean and remove excess lubrication and other substances.
3. Clean Project site (yard and grounds), including landscape development areas, of litter and foreign substances.
4. Sweep paved areas to a broom-clean condition; remove stains, petrochemical spills and other foreign deposits.
5. Rake grounds which are neither planted nor paved, to a smooth, even-textured surface.

B. Compliances:

1. Comply with safety standards and governing regulations for cleaning operations.
2. Do not burn waste materials at site, or bury debris or excess materials on OWNER's property, or discharge volatile or other harmful or dangerous materials into drainage systems.
3. Remove waste materials from site and dispose of in a lawful manner.

4. Dispose of extra materials of value remaining after completion of the associated Work has become the OWNER's property, to OWNER' best advantage as directed.

END OF SECTION

**SECTION 02110
SITE CLEARING**

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 site clearing is shown on drawings.
- B. Site clearing work includes, but is not limited to:
 - 1. Protection of existing trees.
 - 2. Removal of trees and other vegetation.
 - 3. Topsoil stripping.
 - 4. Clearing and grubbing.
 - 5. Removing above-grade improvements.
 - 6. Removing below-grade improvements.

1.03 JOB CONDITIONS

- A. Traffic:
 - 1. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
 - 2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
- B. Protection of Existing Improvements:
 - 1. Provide protection necessary to prevent damage to existing improvements indicated to remain in place.
 - 2. Protection improvements on adjoining properties and on OWNER's property.

- C. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

1.04 Protection of Existing Trees and Vegetation:

- A. 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.
- B. Provide temporary guards to protect trees and vegetation to be left standing.

1.05 Salvable Improvements:

- A. 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

3.01 SITE CLEARING

- A. General:
 - 1. Remove trees, shrubs, grass and other vegetation, improvements, or obstructions interfering with installation of new construction.
 - 2. Remove such items elsewhere on the site or premises as specifically indicated. Removal includes digging out stumps and roots.
 - 3. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.
- B. Topsoil:
 - 1. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches.
 - 2. Satisfactory topsoil is reasonably free of topsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.

3. Remove heavy growths of grass from areas before stripping.
4. Stop topsoil stripping a sufficient distance, where trees are indicated to be left standing, to prevent damage to main root system.
5. 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.
6. Dispose of unsuitable or excess topsoil same as waste material, herein specified.

C. Clearing and Grubbing:

1. Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.
2. Completely remove stumps, roots, and other debris protruding through the ground surface.
3. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.
4. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
5. Place fill material in horizontal layers not exceeding 6-inch loose depth, and thoroughly compact to a density equal to adjacent original ground.
6. Removal of Improvements:
7. Remove existing above-grade and below-grade improvements necessary to permit construction, and other work as indicated.

3.02 DISPOSAL OF WASTE MATERIALS

- A. Burning on OWNER's Property: Burning is not permitted on OWNER's property unless OWNER's approval is obtained and proper authorities are notified.
- B. 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

**SECTION 02200
EARTHWORK**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

1.2 DESCRIPTION OF WORK

Definition: "Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

1.3 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.

1.4 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.

1.5 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

2.1 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

3.1 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 waterbearing 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.

3.2 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 drawings.

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.

3.3 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.

3.4 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.

3.5 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.

3.7 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.

3.8 DISPOSAL OF EXCESS AND WASTE MATERIALS

Disposal of all spoil material resulting from construction shall be the responsibility of the Contractor.

END OF SECTION 02200

**SECTION 02210
GRASSING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

1.2 DESCRIPTION OF WORK

Extent of grassing work is as specified or shown on the construction plans. All other areas disturbed during construction operations shall be seeded.

1.3 QUALITY ASSURANCE

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.

1.4 SUBMITTALS

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 a 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

2.1 TOPSOIL

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.

2.2 SOIL AMENDMENTS

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.

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.

Mulch: Clean hay or fresh straw.

2.3 GRASS MATERIALS

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
BermudaGrass, (<i>Cynodon Dactylan</i>)	80%	15%	25%

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

3.1 GRADING

Areas to be grassed shall be graded to remove depressions, undulations, and irregularities in the surface before grassing.

3.2 PLACING TOPSOIL

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.

3.3 TILLAGE

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.

3.4 APPLICATION OF LIME

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.

3.5 APPLICATION OF FERTILIZER

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.

3.6 PLANTING SOIL

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:

Seed	Rate of Application
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-seed must also be mulched.

3.7 ROLLING

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.

3.8 WINTER COVER

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.

3.9 CLEAN-UP

All excess soil, excess grass materials, stones, and other waste shall be removed from the site daily and not allowed to accumulate.

3.10 MAINTENANCE

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.

3.11 ACCEPTANCE

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 02210

SECTION 02211
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, Perennial 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.

- G. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.
- H. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.
- I. 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

**SECTION 02222
TRENCHING, BACKFILLING AND COMPACTING**

PART 1 - GENERAL

1.01 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

3.01 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.

3.02 EXCAVATION

- A. General:
 - 1. Perform excavation described of whatever substance encountered to the dimensions and depths specified or shown on the drawings.
 - 2. Undercutting will not be permitted, except when ordered by the ENGINEER. Material suitable for backfill shall be stockpiled near the site.
 - 3. Rock or other material undesirable for backfill shall be spoiled outside the area in a neat manner, as directed by the ENGINEER.
 - 4. 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.
 - 5. Backfill over exposed roots as soon as possible.

B. Rock:

1. 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.
2. 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.
2. 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.

- a. Trenches shall be only of sufficient width to provide a free working space on each side of the pipe.
 - b. 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.
 - c. 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.
 - d. 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.
 - e. To protect the pipe lines from unusual stresses, all work shall be done in open trenches.
 - f. 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.
 - a. Where possible, excavated material shall be placed so as not to interfere with public travel.
 - b. Bridging shall be provided to afford necessary access to public or private premises.
 - c. 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.

3.03 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.

3.04 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 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.
2. Material for backfilling shall consist of the excavation, borrow sand or other approved materials, and shall be free of trash, lumber or other debris.
3. 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.
4. Each layer shall be compacted by hand or approved machine tampers with extreme care being exerted not to damage pipe or structures.
5. Backfill shall be placed and compacted evenly against the exposed surfaces to prevent undue stress on any surface.

3.05 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.
 1. Restoration of shoulders shall consist of seeding and mulching or stabilizing with limerock as selected by the ENGINEER.
 2. The cost of doing this work shall be included in the cost of the various applicable items.
 3. 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.

3.06 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.

3.07 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 of 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.

3.08 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.

3.09 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

**SECTION 02500
PAVING QUALITY CONTROL SYSTEM**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The CONTRACTOR shall furnish and maintain a quality control system that will provide reasonable assurance that all materials and products submitted to the ENGINEER for acceptance conform to the contract requirements whether manufactured or processed by the CONTRACTOR or procured from suppliers or subcontractors.
- B. The CONTRACTOR shall perform or have performed the inspection and tests required to substantiate product conformance to contract requirements and shall also perform or have performed all inspections and tests otherwise required by the contract.
- C. The CONTRACTOR shall have a Quality Control Technician, who has been certified by FDOT as a Certified Asphalt Plant Technician; available at the asphalt plant at all times the CONTRACTOR is producing asphalt mix for the contract.
- D. The CONTRACTOR's quality control procedures, inspection, and tests shall be documented and that information is available for review by the ENGINEER throughout the life of the contract.
- E. The CONTRACTOR's person in responsible charge of the paving operations shall also be certified by the FDOT as an Asphalt Paving Technician and shall possess a valid certificate of qualification, and be present during all paving operations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 ENGINEER'S INSPECTION:

- A. The ENGINEER reserves the right to inspect materials not manufactured within the CONTRACTOR's facility.
- B. The ENGINEER inspection shall not constitute acceptance nor shall it in any way replace the CONTRACTOR's inspection or otherwise relieve the CONTRACTOR of his responsibility to furnish an acceptable material or product.
- C. When inspection of the subcontractor's or supplier's product is performed by the ENGINEER, such inspection shall not be used by the CONTRACTOR as evidence of effective inspection of such subcontractor's or supplier's product.

END OF SECTION

SECTION 02510
GENERAL CONSTRUCTION REQUIREMENTS FOR ASPHALT PAVEMENT

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. This Section specifies the general construction requirements for all plant-mixed hot bituminous pavements.

1.02 LIMITATIONS OF OPERATIONS:

- A. Weather Limitations:
 - 1. Plant Operations shall not begin unless all weather conditions are suitable for the laying operations.

1.03 LIMITATIONS OF LAYING OPERATIONS:

- A. General:
 - 1. The mixture shall be spread only when the surface, upon which it is to be laid has been previously prepared, is intact, firm and properly cured, and is dry.
 - 2. Unless otherwise approved by the Engineer, no mixture shall be spread that cannot be finished and compacted during daylight hours.
- B. Temperature:
 - 1. The mixture shall be spread only when the air temperature (the temperature in the shade away from artificial heat) is 40E F and above for layers greater than one inch (100 pounds per square yard) in thickness and 45E F and above for layers one inch (100 pounds per square yard) or less in thickness.
 - 2. No mixture shall be placed when there is evidence that the base is frozen.
- C. Wind:
 - 1. The mixture shall not be spread when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc. are being deposited on the surface being paved, to the extent that the bond between layers will be diminished.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION OF ASPHALT CEMENT:

- A. The asphalt cement shall be delivered to the asphalt plant at a temperature not to exceed 350EF and shall be maintained within a range of 230EF to 350EF in advance of mixing operations.
- B. Heating within these limits shall be constant and wide fluctuations of temperature during a day's production will not be permitted.

3.02 PREPARATION OF AGGREGATES:

- A. Stockpiles:
 - 1. Each aggregate component shall be placed in an individual stockpile, which shall be separated from the adjacent stockpiles, either by space or by system of bulkheads.
 - 2. The intermingling of different materials in stockpiles shall be prevented at all times. Each stockpile, including RAP, shall be identified as shown on the Mix Designs.

3.03 PREVENTION OF SEGREGATION:

- A. In the event that the method used for stockpiling coarse aggregate results in segregation of the aggregate, the Engineer will require that the stockpiles be built up in layers not higher than four feet, with each layer completely in place before the next is started.
- B. Stockpiles shall not be formed by depositing material in one place or by coning.

3.04 BLENDING OF AGGREGATES:

- A. Blending or proportioning from railroad cars will not be permitted.
- B. All aggregates shall be stockpiled prior to blending or placing in the cold hoppers.
- C. All aggregates to be blended or proportioned shall be placed in separate bins at the cold hopper and proportioned by means of securely positioned calibrated gates or other approved devices.

3.05 COLD BINS:

A. Adequacy of Bins:

1. The separate bin compartments of the cold aggregate feeder shall be so constructed as to prevent any spilling or leakage of aggregate from one bin to another.
2. Each bin compartment shall be of such capacity and design as to permit a uniform flow of aggregates.
3. All bin compartments shall be mounted over a feeder of uniform speed, which shall deliver the specified proportions of the separate aggregates to the drier at all times.
4. If necessary, the bins shall be equipped with vibrators to insure a uniform flow of the aggregates at all times.

3.06 GATES:

- A. Each bin compartment shall be provided with a gate that is adjustable in a vertical direction.
- B. The gate shall be so designed that it can be held securely at any specified vertical opening.
- C. The gates shall be equipped with a measuring device for measuring the vertical opening of the gates from a horizontal plane level with the bottom of the feeder.

3.07 MINERAL FILLER:

- A. If mineral filler is required in the mix, it shall be fed or weighed-in separately from the other aggregates.

3.08 HEATING AND DRYING:

- A. The aggregates shall be heated and dried before screening.
- B. The temperature of the aggregates shall be heated and dried before screening.
- C. The temperature of the aggregates shall be controlled that the temperature of the completed mixture at the plant will fall within the permissible range allowed by these specifications.

3.09 SCREENING UNIT:

A. OVERSIZE AGGREGATE:

1. Any oversized pieces of aggregate shall be removed by the use of a scalping screen.
2. This oversized material shall not be returned to the stockpile for reuse unless it has been crushed and reprocessed into sizes that will pass the scalping screen.

B. SCREENING:

1. Unless otherwise permitted by the Engineer, the quantity of aggregates being discharged onto the screens shall not be in excess of the capacity of the screens to actually separate the aggregates into the required sizes.
2. A minimum of ten percent plus-ten material will be permitted in the minus-ten bin.
3. The maximum amount of minus-ten material allowed in the plus-ten bins will be determined by the Engineer, in accordance with its effect on the uniformity of the mix.

C. MIXING DIFFERENT MATERIALS:

1. Unless written permission is obtained, coarse aggregates of different types shall not be mixed; nor shall coarse aggregates of different types be used alternately in sections less than one mile in length.

3.10 PREPARATION OF THE MIXTURE

A. BATCH MIXING:

1. Aggregates:
 - a) The dried aggregates and mineral filler (if required), prepared in the manner previously described, and combined in batches to meet the job mix formula by weighing each separate bin size, shall be conveyed to the empty mixer.
2. Bitumen:
 - a) The hot asphalt cement, accurately measured, shall be introduced into the mixer simultaneously with, or after, the hot aggregates.

- b) Mixing shall continue until the mixture is thoroughly uniform, with all particles fully coated.

3. Mixing time:

- a) The mixing time shall begin when the measuring devices for both the asphalt and the aggregates indicate that all the material is in the mixer, and shall continue until the material begins to leave the mixing unit.
- b) The mixing time will vary in relation to the nature of the aggregates and the capacity of the mixer shall be as designated by the Engineer but in no case shall it be less than 35 seconds.

B. CONTINUOUS MIXING:

- 1. The dried aggregates and mineral filler (if required), prepared as specified and proportioned to meet the job mix formula by volumetric measurements, shall be introduced into the mixer in synchronization with the accurate feeding of the hot asphalt cement.
- 2. The rate of flow of material to the pug mill shall be such that the maintained depth of the mix will not exceed the tips of the paddles when in the upright position.
- 3. Mixing shall be sufficient to produce a thoroughly and uniformly coated mixture.

C. MIXING TEMPERATURE:

- 1. The ingredients of the mix shall be heated and combined in such a manner as to produce a mixture, which shall be at a temperature, when discharged from the pug mill or surge bin, within the range of 230°F to 310°F and within the tolerance shown in Table 1.

Table 1

Temperature Tolerance From Job Mix Formula

Any Single Measurement.....	"25°F
Average of Any Five Consecutive Measurements.....	"15°F

- 2. Any load or portion of a load of asphalt mix at the plant or on the road with mix temperature exceeding 335°F shall be rejected for use on the project.

3. Temperature of the completed mixture shall be determined by a quick-reading thermometer through a hole in the side of the loaded truck immediately after loading. The hole shall be located within the middle third of the length of the body, and at a distance of from six to ten inches above the surface supporting the mixture. If a truck body already has a hole located in the general vicinity of the above-specified location, this will be acceptable. At the Engineer's discretion, the temperature of the load may be taken over the top of the truck in lieu of using the hole in the side of the truck.
4. The mix temperature will be taken at the plant on the first five loads each day and on an average of once every five loads thereafter. If the temperature fails to fall within the specified tolerance range, the Contractor will be required to take corrective action.

3.11 MAXIMUM PERIOD OF STORAGE:

- A. The maximum time that any mix may be kept in a hot storage or surge bin is 72 hours.

3.12 CONTRACTOR'S RESPONSIBILITY FOR MIXTURE REQUIREMENTS:

- A. The responsibility for producing a homogeneous mixture, free from moisture and with no segregated materials, and meeting all requirements of the specifications for the mixture, including compliance with the design limits, shall lie entirely with the Contractor.
- B. These requirements shall apply also to all mixes produced by the drum mixer process and all mixes processed through a hot storage or surge bin, both before and after storage.

3.13 TRANSPORTATION OF THE MIXTURE

- A. The mixture shall be transported in tight vehicles previously cleaned of all foreign material.
- B. The inside surface of the truck bodies after cleaning shall be thinly coated with soapy water or an approved emulsion containing not over five percent oil.
- C. The coating shall be applied prior to the first loading each day and repeated as necessary throughout the day's operations.
- D. After the truck bodies are coated before any mixture is placed therein, they shall be raised to drain out all excess liquids.
- E. Each load shall be covered during cool and cloudy weather and at any time there is a probability of rain.

3.14 PREPARATION OF APPLICATION SURFACES

A. CLEANING:

1. Prior to the laying of the mixture, the surface of the base or pavement to be covered shall be cleaned of all loose and deleterious material by the use of power brooms or blowers, supplemented by hand brooming where necessary.

B. PATCHING AND LEVELING COURSES:

1. Where a surface course is constructed on an existing pavement of old base which is irregular, and wherever so indicated in the plans, the existing surface shall be brought to proper grade and cross section by the application of patching or leveling courses.

C. APPLICATION OVER SURFACE TREATMENT:

1. Where a surface course is to be placed over a newly constructed surface treatment, all loose material shall be swept from the paving area and disposed of by the contractor.

D. COATING SURFACES OF CONTACTING STRUCTURES:

1. All structures which will be in actual contact with the asphalt mixture, with the exception of the vertical faces of existing pavements and curbs or curb and gutter, shall be painted with a uniform coating of asphalt cement to provide a closely bonded, watertight joint.

3.15 TACK COAT

A. TACK COAT REQUIRED:

1. A tack coat will be required on existing pavements that are to be overlaid with an asphalt mix and between successive layers of all asphalt mixes.

B. TACK COAT AT ENGINEER'S OPTION:

1. A tack coat will be required on the following surfaces only when so directed by the Engineer:
2. Freshly primed bases
3. Surface Treatment

3.16 PLACING MIXTURE

A. Requirements Applicable To All Types:

1. Alignment of Edges:

- a) All asphaltic concrete mixtures other than adjacent to curb and gutter or other true edges, shall be laid by the string line method, to assure the obtaining of an accurate, uniform alignment of the pavement edge.

2. Temperature of Spreading:

- a) The temperature of the mix at the time of spreading shall be within "25E F of the established mix temperature selected by the Contractor.
- b) The minimum frequency for taking mix temperatures on the road will be an average of one per five trucks. If the temperature fails to fall within the specified tolerance range, corrective action by the contractor will be required.

3. Rain and Surface Conditions:

- a) Transportation of asphalt mixtures shall immediately cease from the plant when rain begins at the roadway.
- b) Asphalt mixtures shall not be placed while rain is falling, or when there is water on the surface to be covered.
- c) As an exception, mixture caught in transit may be placed at the Contractor's risk if the only option is to waste this mixture, and provided the surface has been tacked (as required) prior to the rain and the surface broomed in front of the spreading operation.
- d) Such mixture will be evaluated separately and if it should prove unsatisfactory in any way, in the opinion of the Engineer, it shall be removed and replaced with satisfactory mixture at the Contractor's expense.

4. Speed of Spreading:

- a) The forward speed of the asphalt spreader shall be as established by the Engineer.

5. Number of Crews Required:
 - a) For each paving machine being operated, the Contractor will be required to use a separate crew; each crew operating as a full unit.
6. Checking Depth of Layer:
 - a) The depth of each layer shall be checked at frequent intervals, not to exceed 25 feet.
 - b) Any deviation from the required thickness, in excess of the allowable tolerance, shall be immediately corrected.
7. Hand Spreading:
 - a) In limited areas where the use of the spreader is impossible or impracticable, the mixture may be spread and finished by hand.
8. Straight-edging and Back-patching:
 - a) Straight-edging and back-patching shall be done after initial compaction has been obtained and while the material is still hot.

3.17 REQUIREMENTS APPLICABLE TO COURSES OTHER THAN LEVELING:

A. Spreading and Finishing:

1. Upon arrival, the mixture shall be dumped in the approved mechanical spreader and immediately spread and struck-off to the full width required and to such loose depth for each course that, when the work is completed, the required weight of mixture per square yard, or the specified thickness, will be secured.
2. An excess amount of mixture shall be carried ahead of the screed at all times.
3. Hand raking shall be done behind the machine as required.

B. Thickness of Layers:

1. Unless otherwise noted in the plans each course shall be constructed in layers of the thickness shown on FDOT Standard Index No. 513.
2. Type S-III Asphaltic Concrete shall be constructed in layers of thickness of not less than: inch nor greater than 13 inches.

C. Laying Width:

1. If necessary due to the traffic requirements, the mixture shall be laid in strips in such a manner as to provide for the passage of traffic.
2. Where the road is closed to traffic, the mixture may be laid to the full width, by machines traveling in echelon.

D. Correcting Defects:

1. Before any rolling is started the surface shall be checked, any irregularities adjusted, and all drippings, fat sandy accumulations from the screed, and fat spots from any source shall be removed and replaced with satisfactory material.
2. No skin patching shall be done.
3. When a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture.

3.18 REQUIREMENTS APPLICABLE ONLY TO LEVELING COURSES:

A. Patching Depressions:

1. Before any leveling course is spread, all depressions in the existing surface more than one inch deep shall be filled by spot patching with leveling course mixture and then thoroughly compacted.

B. Spreading Leveling Courses:

1. All courses of leveling shall be placed by the use of two motor graders - one of which is equipped with a spreader box - unless otherwise shown in the plans.
2. Other types of leveling devices may be used after the Engineer has approved them.

C. Rate of Application:

1. When the total asphalt mix provided for leveling exceeds 50 pounds per square yard, the mix shall be placed in two or more layers, with the average spread of any layer not to exceed 50 pounds per square yard.
2. When Type S-III Asphaltic Concrete is used for leveling, the average spread of a layer shall not be less than 50 pounds per square yard nor more than 75 pounds per square yard.

3. The quantity of mix for leveling shown in the plans represents the average for the entire project; however, the rate of application may vary throughout the project as directed by the Engineer.
4. When leveling in connection with base widening, the Engineer may require that all the leveling mix be placed prior to the widening operation.

D. Placing Leveling Course Over Existing Pavement:

1. When a leveling course is specified to be placed over cracked concrete pavement (including existing concrete pavement covered with an asphaltic surface), the first layer of leveling shall be placed as soon as possible but no later than 48 hours after cracking the concrete.
2. The remainder of the leveling course shall be placed in the normal sequence of operations.

E. Removal of Excess Joint Material:

1. Where a leveling course is to be placed over existing concrete pavement or bridge decks, the excess joint filler in the cracks and joints shall be trimmed flush with the surface prior to placing the first layer of the leveling course.

3.19 COMPACTING MIXTURE:

A. Provisions Applicable To All Types:

1. Equipment and Sequence:
 - a) For each paving or leveling train in operation, the Contractor shall furnish a separate set of rollers, with their operators.
 - b) The following equipment, sequence and coverage are suggested for use based on past successful performance; however, when density is required, the Contractor may select his own equipment, sequence and coverage of rolling to meet the minimum density requirement specified. Regardless of the rolling procedure used, the final rolling must be completed before the internal pavement temperature has dropped below 175E F.
 - c) Seal rolling, using tandem steel rollers (either vibratory or static) weighing 5 to 12 tons, following as close behind the spreader as is possible without pickup, undue displacement or blistering of the material. Vibratory rollers shall be used in the static mode for layers of one inch or less in thickness.

- d) Rolling with self-propelled pneumatic-tired rollers, following up as close behind the seal rolling as the mix will permit. The roller shall cover every portion of the surface with at least five passes.
- e) Final rolling with the 8 to 12-ton tandem steel roller, to be done after the seal rolling and pneumatic-tired rolling have been completed, but before the internal pavement temperature has dropped below 175E F.
- f) Once the Contractor has selected the equipment and established the rolling procedures to achieve required density, then the Contractor must continue to use the same equipment and rolling procedure for the entire project. The Engineer must be notified prior to changing the rolling process.
- g) Compaction at Crossovers, Intersections, etc: when a separate paving machine is being used to pave the crossovers, one 8- to 10-ton tandem steel roller may do the compaction of the crossovers. If crossovers and intersections are placed with the main run of paving, a traffic roller shall also be used in the compaction of these areas.

2. Rolling Procedures:

- a) The initial rolling shall be longitudinal. Where the lane being placed is adjacent to a previously placed lane, the center joint shall be pinched or rolled, prior to the rolling of the rest of the lane.
- b) Rolling shall proceed across the mat, overlapping the adjacent pass by at least six inches. The motion of the roller shall be slow enough to avoid displacement of the mixture, and any displacement shall be corrected at once by the use of rakes, and the addition of fresh mixture is required. Final rolling shall be continued until all roller marks are eliminated.

3. Speed of Rolling:

- a) Rolling with the self-propelled, pneumatic-tired rollers shall proceed at a speed of 6 to 10 miles per hour, and the area covered by each roller shall not be more than 3,000 square yards per hour.

4. Number of Pneumatic-tired Rollers Required:

- a) A sufficient number of self-propelled pneumatic-tired rollers shall be used to assure that the rolling of the surface for the required number of passes will not delay any other phase of the laying operation nor result in excessive cooling of the mixture before the rolling is complete.

- b) In the event that the rolling falls behind, the laying operation shall be discontinued until the rolling operations are sufficiently caught up.
5. Compaction of Areas Inaccessible to Roller:
- a) Areas which are inaccessible to a roller (such as areas adjacent to curbs, headers, gutters, bridges, manholes, etc.) shall be compacted by the use of hand tamps or other satisfactory means.
6. Correcting Defects:
- a) The rollers shall not be allowed to deposit gasoline, oil or grease onto the pavement, and any areas damaged by such deposits shall be removed and replaced as directed by the Engineer.
 - b) While rolling is in progress, the surface shall be tested continuously and all discrepancies corrected to comply with the surface requirements.
 - c) All drippings, fat or lean areas and defective construction of any description shall be removed and replaced.
 - d) Depressions that develop before the completion of the rolling shall be remedied by loosening the mixture and adding new mixture to bring the depressions to a true surface.
 - e) Should any depression remain after the final compaction has been obtained, the full depth of the mixture shall be removed and replaced with sufficient new mixture to form a true and even surface.
 - f) All high spots, high joints and honeycomb shall be corrected as directed by the Engineer.
 - g) Any mixture remaining unbonded after rolling shall be removed and replaced.
 - h) Any mixture that becomes loose or broken, mixed or coated with dirt or in any way defective, prior to laying the wearing course shall be removed and replaced with fresh mixture that shall be immediately compacted to conform with the surrounding area.

3.20 JOINTS:

A. Transverse Joints:

1. Placing of the mixture shall be as continuous as possible and the roller shall not pass over the unprotected end of the freshly laid mixture except when the laying operation is to be discontinued long enough to permit the mixture to become chilled.
2. When the laying operation is thus interrupted, a transverse joint shall be constructed by cutting back on the previous run to expose the full depth of the mat.

B. Longitudinal Joints:

1. For all layers of pavement except the leveling course, placing of each layer shall be accomplished to cause longitudinal construction joints to be offset 6 to 12 inches laterally between successive layers.
2. The Engineer may waive this requirement where offsetting is not feasible due to the sequence of construction.

3.21 SURFACE REQUIREMENTS:

A. Contractor Responsibility:

1. The Contractor shall be responsible for obtaining a smooth surface on all pavement courses placed and therefore should straightedge all intermediate and final courses with a 15-foot rolling straightedge.
2. A 15-foot manual straightedge shall be furnished by the Contractor and shall be available at the job site at all times during the paving operation for checking joints and surface irregularities.

B. Texture of the Finished Surface of Paving Layers:

1. The finished surface shall be of uniform texture and compaction.
2. The surface shall have no pulled, torn, or loosened portions and shall be free of segregation, sand streaks, sand spots, or ripples.
3. Any area of the surface that does not meet the foregoing requirements shall be corrected.
4. Unless written permission is obtained, asphalt concrete mixtures containing aggregates which will cause a different color appearance shall not be used in the final wearing surface in sections less than one mile in length.

END OF SECTION

**SECTION 02512
STABILIZING**

DESCRIPTION:

The work specified in this Section consists of the stabilizing of designated portions of the roadbed to provide a firm and unyielding subgrade, having the required bearing value specified in the plans. When so called for in the plans this work shall also include the additional strengthening of the subbase, by additional stabilizing of the upper portion of the previously stabilized subgrade, within the limits called for. The work shall be constructed in accordance with these specifications and the lines, grades, thicknesses, and notes shown in the plans.

STABILIZED SUBGRADE:

For stabilized subgrade the type of materials, Commercial or Local, is at the Contractor's option. The stabilizing is designated as Type B, compliance with the bearing value requirements will be determined by the Limerock Bearing Ratio Method.

It is the Contractor's responsibility that the finished roadbed section meets the bearing value requirements, regardless of the quantity of stabilizing materials necessary to be added. Also, full payment will be made for any areas where the existing subgrade materials meet the design bearing value requirements without the addition of stabilizing additives, as well as areas where the Contractor may elect to place select high-bearing materials from other sources, within the limits of the stabilizing.

After the roadbed grading operations have been substantially completed, the Contractor shall make his own determination as to the quantity (if any) of stabilizing material, of the type selected by him, necessary for compliance with the bearing value requirements. The Contractor shall notify the Engineer of the approximate quantity to be added, and the spreading and mixing-in of such quantity of materials shall meet the approval of the Engineer as to uniformity and effectiveness.

MATERIALS:

1. **Commercial and Local Materials:** The particular type of stabilizing material to be used shall meet the requirements of Section 914 of FDOT Standard Specifications for Road and Bridge Construction.
2. **Use of Materials from Existing Base:** When the utilization of materials from an existing base is called for, (as all, or a portion, of the stabilizing additives) the Engineer will direct the locations, placing and distribution of such materials, and this work shall be done prior to the spreading of any additional commercial or local materials. Removal of any section of existing base will not be required until the need for it in maintaining traffic is fulfilled. No materials from an existing base will be eligible for payment as Commercial Materials.

The utilization of materials from an existing base may be called for in combination with either of the designated types of stabilizing.

CONSTRUCTION METHOD:

1. **General:** Prior to the beginning of stabilizing operations, the area to be stabilized shall have been constructed to an elevation such that upon completion of stabilizing operations the completed stabilized subgrade will conform to the lines, grades and cross section shown in the plans. Prior to the spreading of any additive stabilizing material, the surface of the roadbed shall be brought to a plane approximately parallel to the plane of the proposed finished surface.

The subgrade to be stabilized may be processed in one course, unless the equipment and methods being used do not provide the required uniformity, particle size limitation, compaction and other desired results, in which case, the Engineer will direct that the processing be done in more than one course.

2. **Application of Stabilizing Material:** When additive stabilizing materials are required, the designated quantity shall be spread uniformly over the area to be stabilized.

When materials from an existing base are to be utilized in the stabilizing at a particular location, all of such materials shall be placed and spread prior to the addition of other stabilizing additives.

Commercial stabilizing material shall be spread by the use of mechanical material spreaders except that where use of such equipment is not practicable other means of spreading may be used, but only upon written approval of the proposed alternate method.

3. **Mixing:** The mixing shall be done with rotary tillers, or other equipment meeting the approval of the Engineer. At the Contractor's election, the mixing of the materials may be accomplished in a plant of an approved type suitable for this work. The area to be stabilized shall be thoroughly mixed throughout the entire depth and width of the stabilizing limits.

The mixing operations, as specified, (either in place or in a plant) will be required regardless of whether the existing soil, or any select soils placed within the limits of the stabilized sections, have the required bearing value without the addition of stabilizing materials.

As an exception to the above mixing requirements, where the subgrade is of rock, the Engineer may direct that the mixing operations (and the work of stabilizing) be waived and no payment for stabilization will be made for such sections of the roadway.

4. **Maximum Particle Size of Mixed Materials:** At the completion of mixing, all particles of material within the limits of the area to be stabilized shall pass a 3 ½ inch ring. Any particles not meeting this requirement shall be removed from the stabilized area or shall be broken down so as to meet this requirement.

5. **Compaction:** Except where a stabilized subbase is also to be constructed after the mixing operations have been completed and requirements for bearing value, uniformity and particle size have been satisfied, the stabilized are shall be compacted, in accordance with Density Requirements of this section. The materials shall be compacted at a moisture content permitting the specified compaction. If the moisture content of the material is improper for attaining the specified density, either water shall be added or the material shall be permitted to dry until the proper moisture content for the specified compaction is reached.

6. **Finish Grading:** The completed stabilized subgrade shall be shaped to conform with the finished lines, grades and cross section indicated in the plans. The subgrade shall be checked by the use of elevation stakes, or other means approved by the Engineer.

7. **Requirements for Condition of Completed Subgrade:** After the stabilizing and compacting operations have been completed the subgrade shall be firm and substantially unyielding, to the extent that it will support construction equipment and will have the bearing value required by the plans.

All soft and yielding material, and any other portions of the subgrade which will not compact readily, shall be removed and replaced with suitable material and the whole subgrade brought to line and grade, with proper allowance for subsequent compaction.

8. **Maintenance of Completed Subgrade:** After the subgrade has been completed as specified above, the Contractor shall maintain it free from ruts, depressions and any damage resulting from the hauling or handling of materials, equipment, tools, etc. It shall be the Contractor's responsibility to maintain the required density until the subsequent base or pavement is in place. Such responsibility shall include nay repairs, replacement, etc., of curb and gutter, sidewalk, etc., which might become necessary in order to recompact the subgrade in the event of underwash or other damage occurring to the previously compacted subgrade. Any such work required for recompaction shall be at the Contractor's expense. Ditches and drains shall be constructed and maintained along the completed subgrade section.

BEARING VALUE REQUIREMENTS:

1. **General:** Bearing value samples will be obtained and tested at completion of satisfactory mixing of the stabilized area. For any area where the bearing value obtained is deficient from the value indicated in the plans, in excess of the tolerances established herein, additional stabilizing material shall be spread and mixed. This reprocessing shall be done for the full width of the roadway being stabilized and longitudinally for a distance of 50 feet beyond the limits of the area in which the bearing value is deficient.

The Contractor shall make his own determination of the quantity of additional stabilizing material to be used in reprocessing.

2. **Tolerances in Bearing Value Requirements:** The following undertolerances from the specified bearing value, will be allowed as based on tests performed on samples obtained after mixing operations have been completed:

<i>Specified Bearing Value</i>	<i>Undertolerance</i>
LBR 40	5.0
LBR 35	4.0
LBR 30 (and under)	2.5
All Florida Bearing Values	5.0

DENSITY REQUIREMENTS:

1. **General:** Within the entire limits of the width and depth of the areas to be stabilized, the minimum density acceptable at any location will be 98 percent of the maximum density as determined by AASHTO T 180.

END OF SECTION 02512

**SECTION 02518
PAINTING TRAFFIC STRIPES**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work under this Section consists of painting reflectorized traffic stripes, including edge stripes and traffic guide.

PART 2 – MATERIALS

2.01 MATERIALS

- A. Traffic Paint:
 - 1. The paint used shall be reflective, fast dry traffic paint as specified in 971-13 of Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, latest edition.
- B. Glass Spheres (for Reflective Traffic Paint):
 - 1. Glass spheres shall conform with the requirements of 971-14 of FDOT Standard Specifications for Road and Bridge Construction, latest edition.

2.02 EQUIPMENT

- A. General:
 - 1. All equipment shall be of a type and design which will readily obtain the required uniformity of application of the stripes, both as to thickness of coating and as to alignment.
- B. Traveling Unit:
 - 1. The traveling unit shall be capable of traveling at a uniform, predetermined rate of speed, both uphill and downhill, in order to produce a uniform application of paint.
- C. Paint Sprayer and Tank:
 - 1. The paint machine shall be of the spray type and shall be capable of spraying the paint to the required spread without thinning of the paint.
 - 2. The paint tank shall be equipped with a mechanical agitator.
 - 3. The nozzles shall have cut-off valves which will automatically apply broken or skip lines.

4. The nozzles shall be equipped with a mechanical bead dispenser that will simultaneously operate with the spray nozzle and distribute the beads in a uniform pattern at the rate specified.
5. Each nozzle shall also be provided with suitable line guides, either metallic shrouds or air blasts.

D. Corrective Devices:

1. Misalignment, defective surfaces, etc. shall be corrected by sand blasting or by any other type of mechanical device which, in the opinion of the ENGINEER, will effectively remove the paint without damage to the pavement surface.

2.03 ALIGNMENT FOR STRIPES

- A. Tack points will be established at appropriate intervals for use in aligning stripes, and if found to be necessary to achieve accuracy a stringline will be set from such points.

2.04 TOLERANCES IN DIMENSIONS AND IN ALIGNMENT

A. Dimensions:

1. Longitudinal Lines:
 - a. No stripe shall be less than the specified width.
 - b. No stripe shall exceed the specified width by more than 2 inch.
 - c. The length of the ten-foot painted segment for skip stripe, and the 30-foot gap between segments, may each vary plus or minus one foot, except that over-tolerance and under-tolerance lengths shall approximately compensate.
2. Transverse Markings, Gore Markings, Arrows, and Messages:
 - a. When the specified width of the markings cannot be made with a single pass and multiple passes are required, the width of the line may vary by plus or minus 1 inch.
3. Alignment:
 - a. On tangents, and on curves up to one degree, the alignment of the painted strip shall not deviate from the stringline by more than 1 inch.
 - b. On curves exceeding one degree the maximum permissible deviation will be 2 inches.

- c. In addition, the outer edge of the edge stripe shall fall uniformly at not less than 2 or more than 4 inches from the edge of the pavement, and shall have no noticeable breaks or deviations in alignment or width.
- B. Correction Rates:
 - 1. Any corrections of variations in the width or in the alignment of the stripes shall not be made abruptly but the stripes shall be returned to the design width at the rate of at least 10 feet for each 2-inch correction, and returned to the stringline at the rate of at least 25 lineal feet per inch of correction.

PART 3 - EXECUTION

3.01 APPLICATION OF PAINT AND SPHERES

- A. Time of Application:
 - 1. Painting shall be done only during daylight hours and, as far as practicable, shall be terminated in time to permit sufficient drying by sunset.
 - 2. Placing of permanent pavement markings on all final asphaltic concrete surfaces shall not be accomplished prior to 30 calendar days after placement of the final surfaces.
 - 3. Temporary pavement striping will be required during the 30 day period if the road is open to traffic.
- B. Weather Limitations:
 - 1. No paint shall be applied when any moisture is present on the surface to be painted or when the air temperature is below 40°F.
 - 2. Painting shall not be done when winds are sufficient to cause spray dust.
- C. Preparation of Surface to be Painted:
 - 1. The surface which is to be painted shall be cleaned, by compressed air or other effective means, immediately before the start of painting, and shall be clean and dry when the paint is applied.
 - 2. Any vegetation or loose soil shall be removed from the pavement before edge striping is begun.

D. Mixing Paint:

1. The paint shall be thoroughly mixed before it is poured into the painting machine and no thinning of the paint in the machine will be allowed at any time.
2. Before the start of each day's work the paint container, the connections, and the spray nozzles on the machine shall be thoroughly cleaned with paint thinner or other suitable cleaner.

E. Paint Application:

1. The traffic stripe shall be of the specified width, with clean, true edges and without sharp breaks in the alignment.
2. A uniform coating of paint shall be obtained and the finished stripe shall contain no light spots or paint skips.
3. Any stripes which do not have a uniform, satisfactory appearance, both day and night, shall be corrected.

F. Broken Stripes:

1. Broken (skip) stripes shall consist of a succession of solid white stripes, 10 feet in length, separated by unpainted spaces 30 feet in length.

NOTE:

All pavement markings other than standard pavement markings, such as parking stripes, shall be as specified in plans.

G. Rate of Paint Application: The minimum rate of application for paint shall be as follows:

1. Four-inch solid traffic stripe: 16.5 gallons per mile.
2. Four-inch skip traffic stripe: 4.12 gallons per gross mile.
3. Any other width stripe: a direct proportion of the above.

H. Required Film Thickness:

1. The minimum wet film thickness for all painted areas shall be 15 mils.

I. Alignment of Stripes:

1. Where a stripe deviates from the correct alignment, as indicated by the stringline, by more than 1 inch in any 50-foot length, it shall be obliterated and the stripe corrected as specified in 710-3.4 of FDOT Standard Specifications.

J. Application of Spheres:

1. The glass spheres shall be applied uniformly and at not less than six pound nor more than 63 pounds of spheres to each gallon of paint.
2. The spheres shall be applied immediately following the paint application.

3.02 PROTECTION OF NEWLY PAINTED STRIPED AND OF TRAFFIC

A. Protection of Stripes:

1. All newly painted stripes, including edge stripes, shall be protected until the paint is sufficiently dry to permit vehicles to cross the stripe without damage from the tires.
2. While the center line stripes are being painted all traffic shall be routed to the right side of the painting operations and the new painted stripe.
3. When necessary, a pilot car shall be used to protect the painting operations from traffic interference.

B. Protection of Traffic:

1. Warning signs shall be set up before the beginning of each operation and extra signs shall be kept well ahead of the painting equipment.
2. The painting equipment shall be so operated that traffic may pass on the right side safely.
3. Warning signs are to be placed only where operations are in progress and are to be relocated as often as is necessary.

C. Protective Devices:

1. The CONTRACTOR shall erect adequate warning signs, provide a sufficient number of flagmen, and take all necessary precautions for the protection of the wet paint number of flagmen, and take all necessary precautions for the protection of the wet paint and the safety of the public.
2. Cones, rubber "Z" guards or similar protective devices shall be placed along the newly painted stripe to prevent traffic from crossing the wet paint.
3. Any such devices used shall be of a type that will not cause damage to vehicular traffic in the event that these objects are accidentally passed over.
4. All protective devices shall be removed not later than sunset to allow free movement of traffic at night.

5. If the CONTRACTOR elects to use fast dry traffic paint no protective devices will be required provided that the CONTRACTOR utilizes a trailing vehicle (behind striping machine) equipped with warning sign and flashing beacon and that he operates such vehicle in a manner consistent with the paint drying time.

D. Repair of Damaged Areas:

1. Any portions of the stripes damaged by passing traffic or from any other cause shall be repainted at the CONTRACTOR's expense.

3.03 CORRECTIVE MEASURES

- A. All painted stripes which fail to meet the specifications, including the permissible tolerances and the appearance requirements, or are marred or damaged by traffic or from other causes, shall be corrected at the CONTRACTOR's expense.
- B. All drip and spattered paint shall be removed to the satisfaction of the ENGINEER.
- C. Whenever it is necessary to remove paint it shall be done by means, as approved by the ENGINEER, which will not damage the underlying surface of the pavement.
- D. When necessary to correct a deviation which exceeds the permissible tolerance in alignment, that portion of the stripe affected shall be removed and repainted in accordance with these specifications.

3.04 ACCEPTANCE OF THE WORK

- A. When the work under this Section has been completed to the satisfaction of the ENGINEER, including any corrections or repairs ordered by the ENGINEER, acceptance of the work painting will be made, independently of the remaining work under the Contract, and the contractor will be relieved of all maintenance of the painting except for damage due to his operations.

END OF SECTION

**SECTION 02520
ASPHALT TESTING**

Test results for testing asphalt densities, thickness and mix design shall be as specified by the Florida Department of Transportation Handbook for Road and Bridge Construction (latest edition).

PART 1 - GENERAL

1.01 TESTING AND ACCEPTANCE:

- A. All roads over 1,000 feet will require coring for in-place density and asphalt thickness.
- B. The cores will be cut at 1,000-foot intervals.
- C. All expenses for these tests are to be paid by the CONTRACTOR.
- D. All test results are to be turned in to ENGINEER before final 25% payment for road will be made.
- E. Payment will be based on the following table, with target density being 96% of mix design lab density.

PAYMENT SCHEDULE FOR DENSITY CORES (Based on Average Density for Each Road)	
PERCENT OF TARGET DENSITY	PERCENT OF PAY
98.0 and above	100
97.0 to less than 98.0	95
96.0 to less than 97.0	90
Less than 96.0*	75

- F. If ENGINEER deems asphalt is acceptable to remain in place, otherwise ENGINEER may require removal and replacement of asphalt.

1.02 THICKNESS:

A. Allowable Deficiencies:

1. The thickness shall be determined from the length of the core borings.
2. The maximum allowable deficiency from the specified thickness shall be $\frac{1}{4}$ inch.

B. Pavement Exceeding Allowable Deficiency in Thickness:

1. When Deficiency is Seriously in Excess:
 - a. Where the deficiency in thickness is in excess of $\frac{1}{4}$ inch, for pavement of less than $2\frac{1}{2}$ inches in specified thickness the CONTRACTOR shall correct the deficiency either by replacing the full thickness for a length extending at least 50 feet from each end of the deficient area, or (when permitted by the ENGINEER) by overlaying as directed by the ENGINEER.
 - b. The CONTRACTOR will receive no compensation for any pavement removed, or for the work of removing such pavement.
2. When Deficiency is Not Seriously in Excess:
 - a. When the deficiency in the thickness of the pavement is over $\frac{1}{4}$ inch but not more than $\frac{1}{2}$ inch, for pavement of specified thickness less than $2\frac{1}{2}$ inches the CONTRACTOR will be allowed to leave such pavement in place, but without compensation.
 - b. The areas of such pavement for which no square yard payment will be made shall be the product of the total distance between acceptable cores, multiplied by the width of the lane which was laid at the particular pass in which deficient thickness was indicated.
 - c. All costs of the overlaying and compacting shall be borne by the CONTRACTOR.
3. Correcting Deficiency by Adding New Surface Material:
 - a. For any case of excess deficiency of the pavement, the CONTRACTOR will be permitted, if approved by the ENGINEER for each particular location, to correct the deficient thickness by adding new surface material and compacting to the same density as the adjacent surface.

- b. The area to be corrected and the thickness of new material added shall be as specified by ENGINEER.
- c. All costs of the overlaying and compacting shall be borne by the CONTRACTOR.

1.03 MIX DESIGN:

- A. An FDOT approved mix design will be provided to the ENGINEER or representative prior to beginning construction, and will not change without written consent of the ENGINEER prior to any change.

1.04 TRUCK TICKETS:

- A. The CONTRACTOR will provide truck tickets to the ENGINEER or representative on a regular basis or as requested by the ENGINEER.

1.05 DAILY ASPHALT PLANT TESTING:

- A. A minimum of one extraction, gradation to be done daily, as well as test performed for stability and flow to be done on each day's production of 100 tons or more. The results of these tests are to be provided to the engineer on a weekly basis.

STRICT COMPLIANCE OF THIS SECTION WILL BE ADHERED TO

END OF SECTION

**SECTION 03310
CONCRETE WORK**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

1.2 DESCRIPTION OF WORK

Extent of concrete work is shown on Drawings.

SUBMITTALS

Product Data: Submit data proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dryshake finish materials, and others as requested by Engineer.

Shop Drawings, Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

Engineer's review is for general engineering applications and features only. Design of formwork for structural stability and efficiency is Contractor's responsibility.

Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test.

1.3 QUALITY ASSURANCE

Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:

ACI 301 "Specifications for Structural Concrete for Buildings".

ACI 318 "Building Code Requirements for Reinforced Concrete".

Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice".

Concrete Testing Services: Engage a testing laboratory acceptable to Engineer to perform material evaluation tests and to design concrete mixes.

Materials and installed work may require testing and retesting at anytime during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.

1.4 PROJECT CONDITIONS

Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.

Protect adjacent finish materials against spatter during concrete placement.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints.

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.

Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

Form Coatings: 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.

Form Ties: Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 1-1/2" to surface.

Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.

2.2 REINFORCING MATERIALS

Reinforcing Bars: ASTM A 615, Grade 60, deformed.

Steel Wire: ASTM A 82, plain, cold-drawn steel.

Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

Welded Deformed Steel Wire Fabric: ASTM A 497.

Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.

For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

Portland Concrete: ASTM C 150, Type I.

Use one brand of cement throughout project, unless otherwise acceptable to Engineer.

Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

Water: Drinkable.

2.4 RELATED MATERIALS

Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

Manufacturer: Subject to compliance with requirements, provide products of one of the following or equal:

AFCO Products The Burke Co. Edoco Technical Products Greenstreet Plastic Products Harbour Town Products

W. R. Meadows Progress Unlimited Schleigel Corp. Vinylex Corp.

Granular Base: Evenly graded mixture of fine and coarse aggregates to provide, when compacted, a smooth and even surface below slabs on grade.

Vapor Retarder: Provide vapor retarder cover over prepared base material where indicated below slabs on grade. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows:

Polyethylene sheet not less than 8 mils thick.

Non-Shrink Grout: CRD-C 621, factory pre-mixed grout.

Products: Subject to compliance with requirements, provide one of the following or equal:

Metallic:

"Vibrofoil", A. C. Horn, Inc.
"Metallic Spec. Grout", The Burke Co.
"Embeco 636", Master Builders
"Ferrolith GDS", Sonneborn-Rexnord
"Hi-Mod Grout", Euclid Chemical Co.
"Kemox G", Sika Chemical Co.
"Ferrogrout", L & M Const. Chemical Co.
"Supreme Plus", Gifford-Hill/American Admixtures

Non-metallic:

"Set Grout", Master Builders
"SonogROUT", Sonneborn-Rexnord
"Euco-NS", Euclid Chemical Co.
"Supreme", Gifford-Hill/American Admixtures
"Crystex", L & M Const. Chemical Co.
"Sure-Grip Grout", Dayton Superior Corp.
"Horngrout", A. C. Horn, Inc.
"Five Star Grout", U. S. Grout Corp.

Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.

Products: Subject to compliance with requirements, provide one of the following or equal:

"Masterseal", Master Builders
"A-H 3 Way Sealer", Anti-Hydro Waterproofing Co.
"Ecocure", Euclid Chemical Co.

"Clear Seal", A. C. Horn, Inc.
"Sealco 309", Gifford-Hill/American Admixtures
"J-20 Acrylic Cure", Dayton Superior
"Spartan-Cote", The Burke Co.
"Sealkure", Toch Div. - Carboline
"Kure-N-Seal", Sonneborn-Rexnord
"Polyclear", Upco Chemical/USM Corp.
"L & M Cure", L & M Construction Chemicals
"Klearseal", Setcon Industries
"LR-152", Protex Industries
"Hardtop", Gifford-Hill

2.5 PROPORTIONING AND DESIGN OF MIXES

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 trial batch method used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

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 Engineer.

Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:

4000 psi 28-day compressive strength; W/C ratio, 0.44 maximum (non-air-entrained).

3000 psi 28-day compressive strength; W/C ratio, 0.58 maximum (non-air-entrained).

2500 psi 28-day compressive strength; W/C ratio, 0.67 maximum (non-air-entrained).

Lightweight Concrete: Proportion mix as herein specified. Design mix to produce strength and modulus of elasticity as noted on Drawings, with a split-cylinder strength factor (F_{ct}) of not less than 5.5 for 3000 psi concrete and a dry weight of not less than 95 lbs. or more than 110 lbs. after 28 days. Limit shrinkage to 0.03 percent at 28 days.

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant;

at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.

Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add airentraining 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 1-1/2 percent within following limits:

Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Ramps, slabs, and sloping surfaces: Not more than 3 inches.

Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.

Concrete containing HRWR admixture (super-plasticizer): Not more than 8 inches after addition of HRWR to site-verified 2-3 inches slump concrete.

Other concrete: Not less than 1 inch nor more than 4 inches.

2.6 CONCRETE MIXING

Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

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

3.1 GENERAL

Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 FORMS

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. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required to work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

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.

Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms. Other trades shall provide location and size of openings. The forms for such openings shall be constructed and set in place under this section.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER INSTALLATION

Following leveling and tamping of granular base for slabs on grade, place vapor retarder sheeting with longest dimension parallel with direction of pour.

Lap joints 6" and seal with appropriate tape.

3.4 PLACING REINFORCEMENT

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

Avoid cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.5 JOINTS

Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Engineer.

Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.

Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

3.6 INSTALLATION OF EMBEDDED ITEMS

General

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. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

3.7 PREPARATION OF FORM SURFACES

Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.8 CONCRETE PLACEMENT

Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement operations.

Cold Weather Placing: 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.

When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees 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.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

Hot Weather Placing: 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.

Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F (32 degrees C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.

Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

3.9 FINISH OF FORMED SURFACES

Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. 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.

Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is ascast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

Grout Cleaned Finish: Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment.

Combine one part portland cement to 1-1/2 parts fine sand by volume, and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.

Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

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:

Scratch Finish: 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.

After placing slabs, plane surface to tolerances for floor flatness (FF) of 15 and floor levelness (FL) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

Float Finish: 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.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with powerdriven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of FF 18 - FL 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

Trowel Finish: 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.

After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of FF 20 - FL 17. Grind smooth surface defects which would telegraph through applied floor covering system.

Trowel and Fine Broom Finish: 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.

Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.11 CONCRETE CURING AND PROTECTION

General

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

Provide moisture curing by the following methods:

- Keep concrete surface continuously wet by covering with water.

- Continuous water-fog spray.

- Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive covers.

Provide moisture-cover curing as follows

- 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. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Provide curing slabs and sealing compounds to exposed interior slabs and to exterior slabs, walks, and curbs, as follows:

- Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

Do not use membrane curing compounds on surfaces which 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, glue-down carpet), painting, and other coatings and finish materials, unless otherwise acceptable to Engineer.

Curing Formed Surfaces: 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. If forms are removed, continue curing by methods specified above, as applicable.

Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.

Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moistureretaining cover, unless otherwise directed.

Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

3.12 SHORES AND SUPPORTS

Remove shoring from ground to roof for structures 4 stories or less, unless otherwise permitted.

Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.

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

Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 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.

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

Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged from facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Engineer.

3.15 MISCELLANEOUS CONCRETE ITEMS

Filling-In: 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. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

Curbs: 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.

Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

Reinforced Masonry: 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. Maintain accurate location of reinforcing steel during concrete placement.

3.16 CONCRETE SURFACE REPAIRS

Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.

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. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces slopped to drain for trueness of slope, in addition to smoothness using a template having required slope.

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.

Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

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. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Engineer.

Repair defective areas, except random cracks and single holes not exceeding 1 inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Perform structural repairs with prior approval of Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.

Repair methods not specified above may be used, subject to acceptance of Engineer.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

The Contractor will employ a testing laboratory, subject to Engineer's approval, to perform tests and to submit test reports.

Sampling and testing for quality control during placement of concrete may include the following, as directed by Engineer.

Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

Slump: 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.

Concrete Temperature: 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.

Compression Test Specimen: ASTM C 31, one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

Compressive Strength Tests: 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 one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

Test results will be reported in writing to Structural Engineer and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION 03310

SECTION 15062

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required and install in the locations as shown on the Drawings.
- B. The CONTRACTOR shall install the plastic piping, fittings and appurtenances (as specified herein) as shown on the Drawings.

1.2 DESCRIPTION OF SYSTEM

The CONTRACTOR shall install the piping in the locations as shown on the Drawings.

1.3 QUALIFICATIONS

- A. All plastic pipe, fittings and appurtenances shall be furnished by a single Manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished.
- B. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.4 SUBMITTALS

- A. The CONTRACTOR shall submit Shop Drawings that include dimensions and technical specifications for all piping to the ENGINEER.
- B. The CONTRACTOR shall submit samples of all materials specified herein to the ENGINEER.
- C. The CONTRACTOR shall submit and shall comply with pipe Manufacturer's recommendation for handling, storing, and installing pipe and fittings.
- D. The CONTRACTOR shall submit pipe Manufacturer's certification of compliance with these Specifications.

1.5 TOOLS

The CONTRACTOR shall furnish special tools, solvents, lubricants, and caulking compounds required for normal installation with the pipe.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyvinyl Chloride (PVC) Pipe:

1. Pressure PVC pipe and accessories 3 inches and smaller in diameter, where shown or as specified in the Drawings, shall meet the requirements of American Society for Testing and Materials (ASTM) D2241 "Polyvinyl Chloride (PVC) Pressure Pipe," and shall be SDR 21, rated pressure of 200 pounds per square inch.
2. PVC Pipe 4 to 8 inches in diameter shall meet the requirements of American Water Works Association (AWWA) Specifications C900 "Polyvinyl Chloride (PVC) Pressure Pipe," and shall be DR18 (Pressure Class 235).
3. PVC Pipe 10 and 12 inches shall meet the requirements of AWWA C900 and shall be DR25 (Pressure Class 165).
4. AWWA C900 DR18 (Pressure Class 235) pipe shall be required for all PVC fire lines downstream of any check valve.
5. PVC Pipe greater than 12 inches shall meet the requirements of AWWA C905 and shall be DR25 (Pressure Class 165).
6. Provisions shall be made for expansion and contraction at each joint with an elastomeric ring, and shall have an integral thickened bell as part of each joint.
7. PVC pipe shall be installed as recommended by the Manufacturer.
8. Pipe shall be furnished in nominal lengths of approximately 20 feet, unless otherwise directed by the ENGINEER.
9. Pipe and accessories shall bear the NSF mark indicating pipe size, Manufacturer's name(s), AWWA and/or ASTM Specification Number, working pressure, and production code.
10. Pipe shall be blue for potable water service, green for sewage force main service, and purple for reclaimed water mains (Pantone 522C).
11. All potable water pipe shall be NSF certified and copies of lab certification shall be submitted to the ENGINEER.

B. Joints:

1. The PVC joints for pipe shall be of the push-on type unless otherwise directed by the ENGINEER so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment.
2. The push-on joint shall be a single rubber gasket joint designed to be assembled by the positioning of a continuous, molded rubber ring gasket in annular recess in the

- pipe or fitting socket and the forcing of the plain end of the entering pipe into the socket; thereby, compressing the gasket radially to the pipe to form a positive seal.
3. The gasket and annular recess shall be designed and shaped so that the gasket is locked in place against displacement as the joint is assembled.
 4. The rubber ring joint shall be designed for thermal expansion or contraction with a total temperature change of at least 750 degrees Fahrenheit (F) in each joint per length of pipe.
 5. The bell shall consist of an integral wall section with a solid cross section elastomeric ring which shall meet requirements of ASTM F-477.
 6. The thickened bell section shall be designed to be at least as strong as the pipe wall.
 7. Lubricant furnished for lubricating joints shall be nontoxic, shall not support the growth of bacteria, shall not have deteriorating effects on the gasket or pipe material, and shall not impart color, taste, or odor to the water.

C. Fittings and Specials:

1. All fittings for PVC pipe shall be cast iron/ductile iron with mechanical joints and shall conform to the specifications for cast iron/ductile iron fittings, unless otherwise directed by the ENGINEER. PVC C-900 fittings are allowable upon approval by the ENGINEER and required for sewage force main applications. DR ratio shall be the same as the pipe.
2. Fittings for Schedule 80 PVC pipe less than 3 inches in diameter shall be threaded and be PVC as shown on the Drawings, or as directed by the ENGINEER. Threaded PVC fittings shall conform to ASTM Specification D2464-69.
3. The Manufacturer of the pipe shall supply all PVC accessories as well as any adaptors and/or specials required to perform the Work as shown on the Drawings and specified herein.
4. Standard double bell couplings will not be accepted where the pipe will slip completely through the coupling.

2.2 COPPER LOCATION WIRE

- A. The CONTRACTOR shall install all piping (including service lines) with underground 12 gauge thermoplastic high heat-resistant nylon (THHN) insulated traceable copper wire.
- B. The CONTRACTOR shall lay the insulated copper wire in the pipe trench 3 to 6 inches above the sewer force mains and shall be a continuous strand from valve box to valve box, wrapped two times around each valve and extended 24 inches inside each valve box to enable location devices to be attached without digging up the valve box.
- C. The CONTRACTOR shall insulate all wire splices.
- D. The CONTRACTOR shall backfill the trench following placement of the traceable wire with due caution to prevent displacement or damage to wire.

- E. The CONTRACTOR shall perform a detection test after insulation and backfill have been completed in the ENGINEER's presence using a commercially available pipe detector furnished by the CONTRACTOR.
- F. The CONTRACTOR shall replace any undetectable wire to the satisfaction of the ENGINEER at no additional expense to the OWNER.

PART 3 - EXECUTION

3.1 STORAGE/INSTALLATION

- A. The CONTRACTOR shall be in strict accordance with the Manufacturer's technical data and printed instruction for the storage and installation of plastic pipe.
- B. The CONTRACTOR shall cover all plastic pipe to prevent fading.
- C. The OWNER reserves the right to reject any pipe not properly stored or pipe that has faded.

3.2 INSPECTION AND TESTING

- A. The CONTRACTOR shall not disturb all pipelines for 24 hours to develop complete strength at all joints.
- B. General:
 - 1. Provide temporary equipment for testing, including pump and gauges.
 - 2. Test piping system before insulation is installed (wherever feasible) and remove control devices before testing.
 - 3. Expel air from the pipe before applying the specified test pressure.
 - 4. Make taps (if necessary) at points of highest elevation, and afterwards tightly plugged.
 - 5. 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.
 - 6. Fill each section with water and subject to a hydrostatic pressure equal to the pressure rating of the pipe being tested.
- C. The CONTRACTOR shall test for the required 2-hour period.
- D. The CONTRACTOR shall test pipe at 150 pounds per square inch (psi), except where fittings are lower class or pressure rating.
 - 1. Pressure Sewer Permissible leakage (2.2 gallons/1,000 feet/24 hours/inch diameter):Inches gallons/1,000 feet/24 Hours gallons/1,000 feet/1 Hours 2" 4.4 gal. 0.19 gal. 3" 6.6 gal. 0.28 gal. 4" 8.8 gal. 0.37 gal. 6" 13.2 gal. 0.55 gal. 8" 17.8 gal. 0.74 gal. 10" 22.0 gal. 0.92 gal. 12" 26.4 gal. 1.10 gal. 14" 30.8 gal. 1.29 gal. 16" 35.2 gal. 1.47 gal. 18" 39.6 gal. 1.66 gal.

2. Water System Permissible Leakage: Inches gallons/1,000 feet/24 Hours
gallons/1,000 feet/1 Hours 2" 3.6 gal. 0.15 gal. 3" 5.4 gal. 0.23 gal. 4" 7.2 gal.
0.30 gal. 6" 10.8 gal. 0.45 gal. 8" 14.4 gal. 0.60 gal. 10" 18.0 gal. 0.75 gal. 12"
21.6 gal. 1.90 gal. 14" 25.2 gal. 1.05 gal. 16" 28.8 gal. 1.66 gal. 18" 32.4 gal.
1.66 gal.
- E. The CONTRACTOR shall repair piping systems sections which fail required piping tests by disassembly and re-installation using new materials to the extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- F. The CONTRACTOR shall, at his own expense, locate and repair the defective joints should any test of combined sections of pipe laid disclose leakage greater than the specified limit, until the leakage is within the specified allowance.
- G. The CONTRACTOR shall provide water for testing.
- H. The CONTRACTOR may subject pipe to hydrostatic pressure, inspect and test for leakage at any convenient time after partial completion of backfill.
- I. The CONTRACTOR may test the system with joints exposed or backfilling complete at his/her option. The ENGINEER shall be notified at least 48 hours before beginning testing.
- J. The CONTRACTOR shall drain test water from piping systems after testing and repair work has been completed.

3.3 CLEANING, FLUSHING, AND INSPECTING

- A. General:
 1. Clean installed piping systems' exterior surfaces of superfluous materials and prepare for application of specified coatings (if any).
 2. Flush out piping systems with clean water before proceeding with required tests.
 3. Inspect each run of each system for completion of joints, supports, and accessory items.
- B. The CONTRACTOR shall thoroughly flush each run of pipe after the mains have been laid and pressure tested so as to remove all debris and foreign matter from the lines.
 1. Flushing will ordinarily be done by opening fire hydrants or blowoffs along the pipe line.
 2. Where fire hydrants or blowoffs are not available or are of insufficient capacity to permit adequate flushing, the pipe line shall be opened and flumes or piping shall be provided by the CONTRACTOR to waste the water to the nearest approved disposal point.
 3. A minimum volume of water equal to six times the volume of the main shall be used to flush the mains.

4. The water shall be introduced into the mains to produce a velocity of not less than 3 feet per second, and this rate of flow shall be continued until the discharge is clear and no evidence of silt or foreign matter is visible.
- C. The CONTRACTOR shall inspect pressure piping in accordance with American Society of Mechanical Engineers (ASME) B31 procedures.
- D. The CONTRACTOR shall disinfect water mains and water service piping in accordance with AWWA C601 and the Florida Department of Environmental Protection (FDEP), Chapter 17-22 requirements.
- E. The CONTRACTOR is responsible for costs (including sampling and analysis) associated with disinfecting the potable water lines.
- F. The CONTRACTOR shall submit sample results documenting compliance with disinfection testing requirements to the FDEP with a duplicate copy sent to the ENGINEER.

END OF SECTION

SECTION 15065
GRAVITY SANITARY SEWAGE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

1.2 DESCRIPTION OF WORK

Extent of sanitary sewage systems work is indicated on drawings.

Sewer collection system work includes, but is not limited to, the following: sanitary sewer conduits and watertight manholes.

Excavation and backfilling for sewer collection system is specified in the applicable sections herein.

1.3 QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of sanitary sewage system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than three years.

Installer's Qualifications: Firm with at least three years of successful installation experience on projects with sanitary sewage work similar to that required for project.

Codes and Standards:

Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of sanitary sewage system materials and products.

1.4 SUBMITTALS

Product Data: Submit manufacturer's technical product data and installation instructions for sewage system materials and products.

Record Drawings: At project closeout, submit record drawings of installed sanitary sewage piping and products. Drawings must be in AutoCAD drawing format.

Maintenance Data: Submit maintenance data and parts lists for sanitary sewage system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

PART 2 - PRODUCTS

2.1 PIPES AND PIPE FITTINGS

General: Furnish elbows, tees, reducing tees, wyes, couplings, increasers, crosses, transitions and end caps of same type and class of material as conduit, or of material having equal or superior physical and chemical properties as acceptable to the Engineer.

Polyvinyl Chloride (PVC) Sewer Pipe 4" or Larger: Use ASTM D 3034, Type PSM, SDR 35; H & W Industries or equal.

PVC Fittings 6" and Larger: ASTM D 3034-89, or elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477-76; J-M Manufacturing or equal.

2.2 CONCRETE MANHOLES

Precast Concrete Manholes and Bases: Sikes Concrete Pipe Co., Hydroconduit, or equal meeting ASTM C 478, sized as indicated. Concrete manholes and bases shall be manufactured in accordance with the latest edition of ASTM SPECIFICATIONS C-478 and C-76 with 4000 PSI CONCRETE, TYPE II CEMENT. Exterior and interior coating shall consist of two (2) coats of bituminous waterproofing material: Koppers 3m or equal. Do not coat joints or pipe opening surfaces.

Manholes shall be constructed to be completely watertight. The contractor shall test the manhole by one of the following methods: (1) Infiltration test: If the manhole is located below the groundwater table, the inverts shall be plugged and the infiltration into the manhole shall be measured after a 12-hour period. If any visible infiltration has occurred into the manhole, visible by wet walls or any accumulation on the bench, the infiltration shall be considered excessive. (2) If the manhole is above the current groundwater table an exfiltration test will be conducted. All incoming sewer lines shall be plugged and the manhole filled with water to a level above the highest section joint. If the water level drop exceeds 1/8" per vertical foot of manhole depth in 30 minutes, the manhole shall have failed the test.

Fittings: In every instance where a pipe enters or leaves a manhole, a watertight fitting shall be provided.

2.3 WATERTIGHT MANHOLE ACCESSORIES

Watertight Manhole Frames and Covers: U. S. Foundary No. 170, Type E, "O" Ring gasketed heavy traffic or equal.

Furnish covers with cast-in legend ("Wakulla County, Sanitary Sewer") on roadway face. Manufacturer shall provide a drawing showing this wording for approval prior to casting.

Manhole Steps: Polypropylene plastic outer shell covering a No. 3 deformed steel bar as manufactured by M. A. Industries, Inc., East Point, Georgia US Foundaries, Inc., Miami, Florida, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE AND FITTINGS

General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.

Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.

Place bell ends or groove ends of piping facing upstream.

Install gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.

Plastic Pipe: Install in accordance with manufacturer's installation recommendations, and in accordance with ASTM D 2321. **The Contractor shall provide for groundwater removal and support of trench walls per ASTM D2321, Section 6. The Contractor is responsible for trench safety.**

Cleaning Piping: Clear 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. In large, accessible piping, brushes and brooms may be used for cleaning. Place plugs in ends of uncompleted conduit at end of day or whenever work stops. Flush lines between manholes if required to remove collected debris.

Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

Make inspections after lines between manholes, or manhole locations, have been installed and approximately 2 feet of backfill is in place, and again at completion of project.

If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects, correct such defects, and reinspect.

3.2 SANITARY MANHOLES

General: Place precast concrete sections as indicated. Where manholes occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set tops 6 inches above finish surface, unless otherwise indicated.

Install in accordance with ASTM C 891.

Provide Ram-Nek joint gasket at joints of sections.

3.3 BACKFILLING

General: Complete backfill operations of open-cut trenches closely following layout, jointing and bedding of pipe, and after initial inspection and testing are completed.

To minimize local area traffic interruptions, allow no more than 100 feet between pipe laying and point of complete backfilling.

3.4 TESTING

Deflection Testing: Unless specified otherwise, the maximum allowable pipe deflection (reduction in vertical inside diameter) shall be 5%. Deflection tests shall be conducted on each section of sewer main 30 days after the completion of all backfilling operations. The maximum allowable deflection shall be 5%. The test shall consist of passing a 5% deflection mandrel through the entire length of the pipe without the mandrel becoming stuck nor requiring the use of excess force. For 8 inch pipe the mandrel shall have a minimum diameter of 7.2 inches. The mandrel may be floated through the pipe using clean water but must be attached to a string of sufficient strength to allow it to be retrieved if it becomes stuck. This test may be performed in conjunction with pipe flushing. All locations with deflection exceeding 5% shall be excavated and repaired by rebedding or replacement of pipes. Optional devices for testing include calibrated television, photography, sewer ball or deflectometer. To ensure accurate testing, the lines must be thoroughly cleaned.

Leakage Testing: The allowable limit of groundwater infiltration or exfiltration for the entire system shall be in complete accordance with ASTM standards and shall not exceed a limit of 200 gal/inch/diameter/mile/day. An infiltration or exfiltration test shall be performed with a minimum positive head of 2 feet (groundwater table at least two feet above the top of the pipe to be tested).

The test will be made by measuring the infiltration flow of water over a measuring weir set up in the invert of the sewer, or by an alternate method approved by the Engineer a known distance from a temporary bulkhead or other limiting point of infiltration. After the sewer or sewers have been pumped out, and normal infiltration conditions prevail, tests shall be started.

Tests shall run continuously for a period of not less than three (3) hours, with weir readings taken at 20 minute intervals. The Contractor shall make the test. The Engineer shall be notified 48 hours in advance. Where infiltration occurs in excess of the specified amount, the defective pipe or joints shall be located and repaired at the expense of the Contractor. If the defective portions cannot be so located, the Contractor, at his own expense, shall remove and reconstruct as much of the original work as necessary to obtain a sewer within the allowable infiltration limits upon such retesting as necessary.

END OF SECTION 15065

SECTION 15070 WATER MAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

1.2 DESCRIPTION OF WORK

Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other sections.

Types of pipes and pipe fittings specified in this section include the following:

- Ductile - Iron Pressure Pipes (Pressure Pipe)
- Plastic Pipes (Pressure Pipes)
- Miscellaneous Piping Materials/Products

Pipes and pipe fittings furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other sections.

1.3 QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

Codes and Standards:

- 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.
- 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.
- NSF Labels: Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundation (NSF).

PART 2 – PRODUCTS

2.1 GENERAL

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.

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.

2.2 DUCTILE-IRON PRESSURE PIPES AND PIPE FITTINGS

Ductile-Iron Pipe: ANSI A21.51; AWWA C151.

Ductile-Iron Fittings: AWWA C110.

Rubber-Gasket Joints: AWWA C111.

Where ductile iron pipe and fittings are to be below ground or installed in a casing pipe, the coating shall be a minimum 1.0 mil thick in accordance with ANSI/AWWA A21.51. Where ductile iron pipe and fittings are to be installed above ground, pipe, fittings and valves shall be thoroughly cleaned and given one field coat (minimum 1.5 mils dry thickness) of rust inhibitor primer. The intermediate and field coats of Alkyd shall also be applied by the Contractor (minimum 1.5 mil dry thickness each coat). Primer and field coats shall be compatible and shall be applied in accordance with the manufacturer's recommendations. Final field coat shall be blue.

All ductile iron pipe and fittings shall have an interior protective lining of cement-mortar with a seal coat of asphaltic material in accordance with ANSI/AWWA A21.4/C104.

2.3 PLASTIC PIPES AND PIPE FITTINGS

Use Polybutylene Pipe (PB) ASTM C 902, SDR 11, or Polyethylene Pipe (PE) ASTM D 1248, D 3350, Type III, Grade P 34 for water services.

Use Polyvinyl Chloride Pipe (PVC) AWWA C 900 (latest revision) for potable water mains. Use either SDR 18 or SDR 25 as shown on the plans.

Pressure Pipe Fitting 4" and Larger: Use mechanical joint, ductile iron Class 350, compact fittings manufactured in accordance with ANSI/AWWA C153/A21.53-84, as manufactured by Union Foundry, or equal.

PE Fittings:

- Butt Heat Fusion: ASTM D 3261.
- Insert Fusion: ASTM D 3197.
- Socket Type: ASTM D 2683.
- Insert: ASTM D 2609.

2.4 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

Welding Materials: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.

Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with Installation requirements.

Gaskets for Flanged Joints: ANSI B16-21, full-faced for cast-iron flanges, raised-face for steel flanges, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

General Instructions:

- All excavation and backfilling for underground piping shall be done in accordance with the applicable sections of these specifications. All pipe, fittings, and valves shall be carefully handled at all times to prevent damage to the pipe or other installations on the job site. Install ductile-iron water mains and appurtenances in accordance with AWWA C 600. Install PVC pressure pipe in accordance with AWWA C605.
- All joints shall be wiped free of all dirt, sand and foreign material and the pipe shall be carefully examined for defects before installation.
- At times when pipe installation is not in progress, the open ends of the pipe shall be closed by approved means and shall remain closed until construction on that particular

section is resumed, eliminating the possibility of any flow obstructions getting into the pipe.

- 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/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance.

3.2 INSTALLATION OF COPPER LOCATION WIRE AND DETECTABLE WARNING TAPE

All non-metallic water mains (including service lines) shall be installed with underground 10 gauge insulated traceable copper wire, and underground locator marking tape. The insulated copper wire shall be buried along with the water main and shall be a continuous strand attached to all fire hydrants and valves. The detectable locator tape is not required over service lines. Locator tape shall be installed a minimum of 12 inches below ground surface or pavement directly over the pipeline. Detectable locator tape shall run continuously and where splicing is required, shall be over-lapped a minimum of 12 inches. The locator tape shall be of an inert polyethylene material having a minimum thickness of 0.1 mm and shall be color-coded as adopted by the American Public Works Association and the Florida Utilities Coordination Committee. Following placement of the detectable locator tape and traceable wire, the trench shall be backfilled with due caution to prevent displacement or damage to either. After insulation and backfill have been completed the contractor shall perform a detection test in the Engineer's presence using a commercially available pipe detector furnished by the Contractor. Any undetectable tape or wire shall be replaced by the Contractor to the satisfaction of the Engineer at no additional expense to the Owner.

3.3 PVC FITTINGS

PVC fittings will not be used on pressure pipe larger than 3" in diameter.

3.4 PIPING SYSTEM JOINTS

General: Provide joints of type indicated in each piping system.

Weld pipe joints of steel water pipe in accordance with AWWA C 206.

Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards.

Heat Joining of Thermoplastic Pipe: ASTM D 2657.

3.5 RESTRAINING:

All bends, tees, plugs, and caps shall be restrained using inline-restraining device; Mega Lug Series or approved equal. Precast concrete thrust blocking shall not be used unless directed by the Engineer.

3.6 CLEANING, FLUSHING, INSPECTING

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 before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

Inspect pressure piping in accordance with procedures of ASME B 31.

Disinfect water mains and water service piping in accordance with AWWA C 601.

3.7 WATER MAIN PIPING TEST

General: Provide temporary equipment for testing, including pump and gauges. Test piping system 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 water and pressurize for indicated pressure and time. Required test period is 2 hours. Test pipe at 150 psi, except where fittings are lower Class or pressure rating.

Permissible leakage:

	<u>gal's/1000'/24 hrs</u>	<u>gal's/1000'/1 hr</u>
1-1/4"	2.4 gal.	0.10 gal.
1-1/2"	2.9 gal.	0.12 gal.
2"	4.1 gal.	0.17 gal.
2-1/2"	5.0 gal.	0.21 gal.
3"	6.0 gal.	0.25 gal.
4"	7.9 gal.	0.33 gal.
6"	12.0 gal.	0.50 gal.
8"	15.8 gal.	0.66 gal.
10"	19.9 gal.	0.83 gal.
12"	23.8 gal.	0.99 gal.
14"	27.8 gal.	1.16 gal.
16"	31.7 gal.	1.32 gal.

18"

35.8 gal.

1.49 gal.

Should any test of combined sections of pipe disclose leakage greater than the specified limit, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

Water for testing shall be provided by the Contractor.

Pipe may be subjected to hydrostatic pressure, inspected and tested for leakage at any convenient time after partial completion of backfill. The Contractor may test the system with joints exposed or backfilling complete at his option. The Engineer shall be notified at least 48 hours before beginning testing.

Drain test water from piping systems after testing and repair work has been completed.

END OF SECTION 15070

SECTION 15080
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. Submittals during construction shall be made in accordance with Section 01300.
- B. 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.
- C. 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."
- D. 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.
- E. 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 02200 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 recompact 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.

SDR-35		SDR-26		
Nominal SizeDiameter (Inches)	Base Inside Mandrel (Inches)	5% Deflection Diameter (Inches)	Base Inside Mandrel (Inches)	5% Deflection (Inches)
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

TYPE T 1		TYPE T-2		
Nominal SizeDiameter (Inches)	Base Inside Mandrel (Inches)	5% Deflection Diameter (Inches)	Base Inside Mandrel (Inches)	5% Deflection (Inches)
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:

Pipe Diameter "D" in Inches							
Length of Test Sec. "L" (ft.)	8	10	12	15	18	21	24
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.

VACUUM TEST TIMETABLE

Depth - Feet	DIAMETER - INCHES		
	48"	60"	72"
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

SECTION 15085

STORM SEWER COLLECTION SYSTEM

PART 1 - GENERAL

15.1 INTENT

It is the intent of these specifications to provide supplemental information to the contents of the construction drawings on the quality of material, execution, measurement, etc. These specifications are general in nature and may contain products and requirements which are not applicable to the project. Discrepancies between these specifications and the construction drawings, either imagined or real, shall be brought to the attention of the Owner's Engineer for clarification.

15.2 DESCRIPTION OF WORK

Extent of storm sewer collection system work is shown on drawings.

Storm sewer collection system work includes, but is not limited to, the following:

Storm sewer piping; manholes, frames and gratings; grate inlets, frames and gratings; outfall structures; junction boxes; end walls; mitered end sections; rip-rap; skimmer.

Comply with the requirements of Trenching, Backfill and Compacting sections – 02222 for excavation and backfilling required in connection with a storm sewer system work.

Comply with requirements of Concrete Work sections – 03310 for concrete work required in connection with storm sewer collection system work.

15.3 QUALITY ASSURANCE

Codes and Standards: Perform all work in compliance with applicable requirements of governing authorities having jurisdiction.

Testing and Inspection: Testing and inspection shall be performed by the Owner's Engineer and the Contractor's Geotechnical Engineer at the Contractor's expense.

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.

15.4 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 applicable items: Precast items; outfall structure; skimmer; grates; lids; frames; stone for rip-rap.

PART 2 - PRODUCTS

15.5 CONDUIT MATERIALS

Reinforced Concrete Pipe (RCP): All round RCP shall conformed to ANSI/ASTM C 76, Class III, Wall 'B', with modified tongue-and-groove compression gasket joints complying with ANSI/ASTM C 443. All Reinforced Concrete Pipe (RCP) installed under paved areas to have tongue and groove compression gasket installed with filter fabric wrap around exterior of each pipe joint. All fittings shall be pre-cast and meet requirements for Class III Pipe. RCP shall conform to ASTM C506 for Arch Pipe and ASTM C507 for Elliptical Pipe, or meet Florida Department of Transportation specifications for concrete pipe.

High Density Polyethylene Pipe (PE or HDPE): HDPE pipe shall conform to AASHTO M 294 Type S (non-perforated circular cross section, with corrugated outer surface and smooth inner surface), and meet Florida Department of Transportation specifications for Polyethylene Storm Drain Pipe. Outside diameter shall match the outside diameter of RCP wall B joints. Joint coupling bands shall be of the same material as the pipe and shall, when fastened in place, provide the joint with the same or greater structural properties as the remainder of the pipe. Joint coupling bands shall prevent infiltration of soil. End sections shall be RCP flared end sections, meeting the requirements listed in this Section for RCP fittings. This pipe shall have a minimum of on foot cover with earth or crushed rock in addition to the required bedding.

15.6 CONCRETE STRUCTURES

Reinforced Concrete Boxes (RCB): RCB sections shall conform to the Florida Department of Transportation standards or ASTM C1433. Manufacturers design tables shall be appropriate for loading conditions. Designs not take from loading design tables shall be sealed by a professional engineer.

15.7 METAL ACCESSORIES

Manhole Frames and Covers: Grey cast iron in accordance with ANSI/ASTM A 48, Class 30 B. Manhole frames and covers shall be traffic rated.

Manhole Steps: Grey cast iron, ANSI/ASTM A 48, Class 30 B, integrally cast into manhole sidewalls, unless otherwise indicated.

Grates and Frames: Grates and frames for inlets shall be either cast iron or steel as shown on the drawings. Cast iron grates and frames shall be grey cast iron in accordance with ANSI/ASTM A 48, Class 30 B. Steel grates and frames shall be structural steel galvanized in accordance with

ASTM A 123. Grates and frames shall be traffic rated unless otherwise specified on the construction drawings.

15.8 RIP-RAP

Rip Rap shall be placed as specified on the construction drawings and conform to FDOT Specification Section 530 – 2.2.2 Rubble for Ditch Lining.

PART 3 - EXECUTION

15.9 INSTALLATION OF CONDUIT

General: Install conduit in accordance with the manufacturer's specifications and the governing authorities having jurisdiction, if discrepancy occurs between installation specifications, the more stringent requirements are indicated.

Inspect conduit before installation to detect apparent defects. Mark defective materials and promptly remove from site.

Grade and Alignment: The Engineer will provide the Contractor with line and grade information. It shall be the Contractor's responsibility to install the sewer according to plans. Three (3) batter boards, a top line and grade pole or laser beam shall be used for this purpose unless some other method of checking the inner lower grade and line is approved by the Engineer in writing. The Contractor must test the ditch or grade of the top line and sewer, and will be held responsible for the correct flow of storm sewers. Any apparent inaccuracy in grade stakes shall be called to the Engineer's attention immediately upon discovery. The Contractor shall provide and maintain on the work at all times a laser beam or a gauge rod of sufficient length to reach from the invert of the sewer pipe being laid to the top line strung on the three batter boards. The gauge rod shall be graduated and numbered each foot of its entire length. The gauge rod shall be equipped with either a plumb line or two spirit levels and the utmost care used to insure a truly vertical gauge rod at the time the reading is taken and pipe being set. In the event a laser beam is used to set line and grade for the pipe laying operation, the laser must be checked at the beginning of each day and at least once between structures and at any other time the Engineer deems it necessary to insure the proper line and grade of the pipe.

Pipe Laying: Installation of pipe shall proceed from the downstream end of the project with bell ends facing upstream. Alignment and grade shall be uniform between the manholes, and a positive system of grade control shall be used for maintaining alignment. Due to difficulty of compacting beneath wide pipes, loose bedding material shall be shaped to receive the full length of the pipe except where required to mate joints. The ends of the installed pipe shall be plugged whenever the work is not in progress. Joint installation shall follow the manufacturer's recommendation.

Cleaning Conduit: Clear interior of conduit of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.

In large, accessible conduit, brushes and brooms may be used for cleaning.

Flush lines between manholes or inlets if required to remove collected debris.

Closing Abandoned Utilities: Close open ends of abandoned underground utilities which are indicated to remain in place. Provide sufficiently strong closures to withstand hydro-static or earth pressure which may result after ends of abandoned utilities have been closed.

Close open ends of concrete or masonry utilities with not less than eight inches brick masonry bulkheads.

Interior Inspection: Inspect conduit to determine whether line displacement or other damage has occurred.

Make inspections after lines between manholes or inlets, or manhole/inlet locations, have been installed and approximately two feet of backfill is in place and at completion of project.

If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects to satisfaction of Engineer.

15.10 UNDERGROUND STRUCTURES

Precast Concrete Structures: Place precast concrete sections as shown on drawings. Where structures occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set tops three inches above finish surface, unless otherwise indicated.

Use epoxy bonding compound where steps are mortared into structure walls.

Provide rubber joint gasket complying with ASTM C 443.

Connections: Make connections to existing conduits and underground structures, so that finished work will conform as nearly as practicable to requirements specified for new work.

Take care while making connections to prevent concrete or debris from entering existing conduit or structure. Remove debris, concrete or other extraneous material which may accumulate.

15.11 BACKFILLING

Ditches and Detention Areas: The construction of ditches and detention areas shall include the removal and disposal of old pavement, curb, gutter, sidewalk, etc. and the removal and disposal of all vegetation. The ditches and detention areas shall be excavated, shaped and sloped in accordance with the line, grade and cross sections indicated on the plans. The excavated material shall be removed and wasted as directed by the Engineer at the Contractor's expense.

15.12 TESTING AND INSPECTION REQUIREMENTS

Alignment Testing: To verify alignment and workmanship, installed pipe may be lamped or televised. Lamped sections shall have no elongation of the silhouette or evidence of debris or dirt in the pipe. Televised pipe shall be inspected for a smooth, structurally sound, straight main. Pipe may also be televised at the end of the warranty period. Unacceptable defects include displacement at joints, intrusion of foreign material, and cracked or distressed pipe. Pipe not passing alignment tests shall be repaired or replaced or retested. For short runs of pipe, where feasible, visible inspection of the interior of the pipe shall be acceptable. Contractor shall be responsible for ensuring proper inspection of pipes is performed throughout construction.

END OF SECTION 15085

SECTION 15090 HDPE PIPE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

This section includes material and installation requirements necessary for furnishing and installing HDPE pipe, fittings and specials in the locations and quantities as shown on the drawings. Quantities shown on the plans may not be the exact length needed for directional bores. The Contractor shall investigate this before the Bid and shall inform the Engineer prior to the bid if additional HDPE pipe will be needed. Any additional HDPE pipe needed after the Bid will be the responsibility of the Contractor and shall not require any additional costs to the Owner.

1.2 QUALITY CRITERIA

Reference to industry standards as contained herein shall be construed as to be in reference to the latest revision or edition.

The pipe fittings and specials shall be made by a manufacturer experienced in producing pipe, fittings, and specials of the type, size, configuration, and quality specified herein. The manufacturer shall have produced pipe, fittings and specials having a record of at least five years successful performance.

1.3 SUBMITTALS

The Contractor shall submit shop drawings showing the pipe lengths, design details, joint details, specials, etc., for the Engineer's approval. Pipe shall be fabricated in accordance with these plans.

The Contractor shall submit a notarized statement of certification from the pipe manufacturer as to conformance with the specified ANSI/AWWA Specifications listed herein, and modifications thereto, at the time of submitting shop drawing data on the pipe and fittings.

1.4 DELIVERY, STORAGE AND HANDLING

The Contractor shall be responsible for the acceptability of all material furnished by him and shall assume responsibility for the replacement of all such material found damaged in shipping, or defective in manufacture. This shall include the furnishing of all material and labor required

for the replacement of installed material discovered to be defective prior to the final acceptance of the work.

The interior, as well as all sealing surfaces of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter. Consult the manufacturer for specific storage recommendations.

Materials shall, at all times, be handled properly to prevent damage in accordance with manufacturer's recommendations. Pipe and fittings shall not be thrown, dropped, or dragged.

PART 2 - PRODUCTS

2.1 HDPE PIPE

Polyethylene pipe shall be manufactured in accordance with ASTM F714. All HDPE pipe used for force mains shall have an embedded green stripe on each side, all pipe used for water mains shall have an embedded blue stripe on each side, and all pipe used for reclaimed water shall have an embedded purple stripe on each side.

The polyethylene pipe shall be rated for use with water at 73.4°F at a hydrostatic design stress of 800 psi and a minimum working pressure of 160 psi.

Dimension Ratio (DR) shall be DR11 for the HDPE pipe shown on the drawings. All pipe shall be DIP size.

Polyethylene extrusion compound from which the polyethylene pipe is extruded shall comply with application requirements for PE-3408 high molecular weight polyethylene plastic material. Material shall be as described in ASTM D1248 and shall comply with the following:

1. Pipe resin shall have a minimum inherent viscosity of 2.5 when run according to ASTM D1601.
2. Exceed 5,000 hours on ESC as determined by ASTM D-1248-345434C.
3. Have a specific gravity of between 0.9141 and 0.955.
4. Contain a minimum of 2% and a maximum of 3% of carbon black and shall produce a finish product that is uniformly black.

Marking on the pipe shall include: the nominal pipe or tubing size; the type of plastic material, i.e., PE-3408; the standard thermoplastic pipe dimension ratio or the pressure rating in psi for water at 73.4°F. (160 psi); the ASTM designation with which the pipe complies; and manufacturer's name or trade mark and code.

2.2 FITTINGS AND JOINTS

Fittings shall be fabricated to the same standards as the pipe from the same raw materials by thermal fusion. Jointing shall be by the thermal butt fusion method as recommended by the manufacturer. Fittings and joints shall have a pressure rating equal to the pipe and shall have

machined fusion ends matched to pipe wall. The Contractor shall use mechanical joint fusion welded adapters with ductile iron mechanical joint sleeves for transition connections as shown on the plans.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

Installation of all polyethylene pipe, fittings, specials and appurtenances shall be in accordance with the Manufacturer's Instructions.

Openings such as stubs, tees and other services along the lines shall be securely closed by means of an approved stopper that fits into the pipe and is recommended by the pipe manufacturer. This stopper shall be jointed in such a manner that it may be removed at some future time without injury to the pipe itself. At the close of each day's work and other times when the pipe is not being laid, the end of the pipe shall be temporarily closed with a close-fitting stopper.

Cleaning - All necessary precautions shall be taken to prevent the entrance of mud, sand or other obstructing material into the pipelines. As the work progresses, the interior of the main shall be cleaned of all dirt, jointing material, and superfluous materials of every description.

Joining of piping shall be performed by experienced fusion technicians with a minimum of five (5) years or more experience in field application involving large diameter (over 12-inches) polyethylene pipe. Experience record shall be submitted for review 15 days prior to directional boring activities.

If the Contractor feels that the length of HDPE pipe shown on the plans is not adequate, then the Contractor shall notify the Engineer prior to the bid. Contractor shall not ask for additional directional boring cost after the bid.

Handling:

1. Pipe must be handled in a way to insure that it is not gouged or scratched to a depth of more than 10% of the wall thickness.
2. Pipe shall not be bent to a radius of less than 20 diameters at any time during installation.
3. Pipe shall be handled at all times with strapping that a combined width at each load area of at least half the pipe diameter to prevent point damage to the pipe. No wire rope slings shall be used. Contractor shall use the locator wire on all HDPE pipe.

3.2 TESTING IN THE TRENCH

Fill the pipeline with water after it has been laid; bleed off any trapped air. Subject the lowest element in the system to a test pressure that is 1.5 times the design pressure, and check for any

leakage. When in the pinion of the engineer, local conditions require that the trenches be backfilled immediately after the pipe has been laid, apply the pressure test after backfilling has been completed but not sooner than a time which will allow sufficient curing of any concrete that may have been used. Typical minimum concrete curing times are 36 hours for early strengths and seven days for normal strengths.

The test procedures consist of two steps: the initial expansion and the test phase. When test pressure applied to a water-filled pipe, the pipe expands. During the initial expansion of the pipe under test sufficient make-up water must be added to the system at hourly intervals for three hours to maintain the test pressure. After about four hours, initial expansion should be complete and the actual test can start.

When the test is to begin, the pipe is full of water and is subjected to a constant test pressure of 1.5 times the system design pressure. The test phase should not exceed three hours, after which time any water deficiency must be replaced and measured. Add and measure the amount of make-up water required to return to the test pressure and compare this to the maximum allowance in Figure 4.1.

An AlterNette leakage test consists of maintaining the test pressure (described above) over a period of four hours, and then dropping the pressure by 10 psi (0.069 Mpa). If the pressure then remains within 5% of the target value of one hour, this indicates there is no leakage in the system.

NOTE: Under no circumstances shall the total time under test exceed eight (8) hours at 1 ½ times the system pressure rating. If the test is not complete within this time limit (due to leakage, equipment failure, etc.), the test section shall be permitted to “relax” for eight (8) hours prior to the next test sequence. Air testing is not recommended. Additional safety precautions may be required.

FIGURE 4.1
ALLOWANCE FOR EXPANSION UNDER TEST PRESSURE

Nominal Pipe Size inches (1)	U.S. Gals/100 feet of Pipe (2)			Nominal Pipe Size Inches (1)	U.S. Gals/100 feet of Pipe (2)		
	1-Hour	2-Hour	3-Hour		1-Hour	2-Hour	3-Hour
2	0.08	0.12	0.15	20	2.80	5.50	8.00
3	0.10	0.15	0.25	22	3.50	7.00	10.50
4	0.13	0.25	0.40	24	4.50	8.90	13.30
5	0.21	0.41	0.63	28	5.50	11.10	16.80
6	0.30	0.60	0.90	30	6.20	12.60	19.10
8	0.50	1.00	1.50	32	7.00	14.30	21.50
10	0.75	1.30	2.10	36	9.00	18.00	27.00
12	1.10	2.30	3.40	42	12.00	24.00	36.00
14	1.40	2.80	4.20	48	15.00	27.00	43.00
16	1.70	3.30	5.00	54	18.00	30.00	50.00

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18	2.20	4.30	6.50				
(1) mm* 0.03937 (2) multiply by 11.53 to convert to liter/100 meters of pipe							

END OF SECTION 15090

**SECTION 15101
VALVES AND ACCESSORIES**

PART 1 – GENERAL

1.1 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.

1.2 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.

1.3 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 Fitting
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.

1.4 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.

1.5 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.

1.6 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

2.1 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.

2.2 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.

2.3 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.

2.4 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.

2.5 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
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, bidirectional 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-gearred 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-SP60.
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.

2.6 PLUG VALVES

- A. Plug valves shall be of the offset disc type, $\frac{1}{4}$ 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, ValMatic, 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.

2.7 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.

2.9 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

3.1 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.

3.2 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.

3.3 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.

3.4 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.

3.5 CLEANING

All items (including valve interiors) shall be cleaned prior to installation, testing, disinfection and final acceptance.

3.6 DISINFECTION

Disinfection of valves and appurtenances shall be in accordance with AWWA Requirements.

3.7 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 top of the box as shown in the standard details.

END OF SECTION

**SECTION 15120
FIRE HYDRANT ASSEMBLIES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Special Conditions, apply to work of this section.

1.2 QUALITY ASSURANCE

Manufacturer's Qualifications: 1. Firms regularly engaged in manufacture of piping specialties, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

PART 2 - PRODUCTS

2.1 FIRE HYDRANTS

A. All fire hydrants shall be 5-1/4 inch hydrants with two 2-1/2 inch connection and one pumper connection designed for 150 psi working pressure, and shall conform to the requirements of AWWA C-502-73 (Latest Revision). Hydrants shall have mechanical joint inlets, shall be for a 3-foot, or depth as required bury depth, and shall have a compression type main valve which opens against pressures. The hydrant main valve operating parts, including valve seal, valve seal insert, cross arm, and upper valve washer shall be all bronze, meeting either of the following ASTM B-61, or B-150 per C-502.

B. The barrel section of the hydrant shall be made in two or more sections, with a flange located at least 2 inches above the finished grade line, and provided with a break flange, flange clips or lugs at ground line. Undercut bolts for the break connection are not acceptable.

C. The hydrants shall open left (counterclockwise). They shall have pentagon shaped operating nuts and cap nuts measuring 1-1/2 inches from pint to flat. The bonnet shall be of dry type top design. The hydrants stem shall have "O" ring seals, and stem threads and bearing shall be protected with automatic self-oiling or grease case lubricant systems. Hydrants having stem thread (upper or lower) that are constantly exposed or immersed in water are not acceptable.

D. All exposed or external nuts and bolts shall be stainless steel, no exceptions.

E. All fire hydrants shall be M & H, Muller, American Darling, or approved equal. The external color shall be red and the primer color shall not be yellow. After installation the fire hydrants shall be free of scratches and paint chipping. All fire hydrants shall be painted after installation if in the opinion of the Engineer the coating is not satisfactory. Four fire hydrant wrenches shall be supplied for this project. All fire hydrants shall be covered with plastic when installed and removed, when the line is placed into service to prevent damage during construction and to prevent emergency use until available.

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PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, 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.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. 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, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- 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. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by 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 Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- H. 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.
- I. 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. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 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 Statement: Submit a statement 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, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is 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.

1.5 ACTION SUBMITTALS

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Contractor's quality-control personnel.
- 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.

- C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

- D. Reports: Prepare and submit certified written reports and documents as specified.

- E. Permits, Licenses, and Certificates: For Owner's record, 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.

1.7 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, telephone number, and email address 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 inspection.
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.

1.8 QUALITY ASSURANCE

- A. 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- 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, applying, 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 is similar in material, design, and extent to those indicated for this Project.
- F. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1.9 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 inspection 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, and the Contract Sum will be adjusted by Change Order.
 - B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection 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 inspection 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. 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.
 - D. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives 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 inspection. 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 inspection equipment at Project site.
 - E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- 1.10 SPECIAL TESTS AND INSPECTIONS
- A. engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
 1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. 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.

3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
5. 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 Architects and authorities' having jurisdiction reference during normal working hours.
 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, 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. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."
- 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 01 40 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum railings.
- B. Related Requirements:

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. 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.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2.
 - 3. Fasteners.
 - 4. Post-installed anchors.
 - 5. Handrail brackets.
 - 6. Metal finishes.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.

- C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- D. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
- 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 ALUMINUM RAILINGS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- C. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- D. Plate and Sheet: ASTM B209, Alloy 6061-T6.
- E. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.
- F. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.4 FASTENERS

- A. Fastener Materials:
 - 1. Aluminum Railing Components: Type 304 stainless steel fasteners.
 - 2. Finish exposed fasteners to match appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.

2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

2.5 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast aluminum, center of handrail 2-1/2 inches from face of railing.
- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 1. Clearly mark units for reassembly and coordinated installation.
 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
 1. Provide weep holes where water may accumulate.
 2. Locate weep holes in inconspicuous locations.

- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay
- I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- K. Form changes in direction as follows:
 - 1. As detailed.
- L. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- M. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

2.7 ALUMINUM FINISHES

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other

components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

- B. Mill Finish: AA-M12, nonspecular as fabricated.
- C. Clear Anodic Finish: AAMA 611, AA-M12C22A31.
 - 1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

3.3 ATTACHING RAILINGS

- A. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For wood railing, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.

3.4 REPAIR

3.5 CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 13

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preserved-treated lumber.
3. Dimension lumber framing.
4. Plywood backing panels.

B. Related Requirements:

1. Section 06 17 53 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than **2 inches nominal** size in least dimension.
- B. Dimension Lumber: Lumber of **2 inches nominal** size or greater but less than **5 inches nominal** size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.

1.3 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-preserved 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.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. 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.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products 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

- A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are

- 4. minimum dressed sizes for dry wood products.
 - 4. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content:
 - 1. Boards: 19 percent.
 - 2. Dimension Lumber: 19 percent unless otherwise indicated.
- 2.2 WOOD-PRESERVATIVE-TREATED LUMBER
 - A. Preservative Treatment by Pressure Process: AWP A U1, Use categories as follows:
 - 1. UC3B (Commodity Specification A): Uncoated sawn products in exterior construction not in contact with ground, exposed to all weather cycles including intermittent wetting but with sufficient air circulation for wood to dry. Excludes sawn products not in contact with ground but with ground contact-type hazards. Include all rough carpentry.
 - 2. UC4A (Commodity Specification A): Non-critical sawn products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, and sawn products not in contact with ground but with ground contact-type hazards or that are critical or hard to replace. Include all rough carpentry.
 - 3. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - 4. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
 - 5. After treatment, redry dimension lumber to 19 percent maximum moisture content.
 - 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.
 - 1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.
 - D. Application: Treat all rough carpentry unless otherwise indicated.
- 2.3 DIMENSION LUMBER FRAMING
 - A. Non-Load-Bearing Interior Partitions by Grade: Construction or No. 2 grade.
 - 1. Application: All interior partitions.
 - 2. Species:
 - a. Spruce-pine-fir
 - B. Load-Bearing Partitions by Grade: No. 2 grade.
 - 1. Application: Exterior walls and interior load-bearing partitions.
 - 2. Species:
 - a. Spruce-pine-fir
 - C. Joists, Rafters, and Other Framing by Grade: No. 2 grade.
 - 1. Species:
 - a. Southern Pine
 - D. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 - 1. Species and Grade:
 - a. As indicated above for load-bearing construction of same type.
- 2.4 MISCELLANEOUS LUMBER
 - A. Provide miscellaneous lumber indicated and lumber for support or attachment of other

construction, including the following:

1. Blocking.
 2. Nailers.
 3. Furring.
 4. Grounds.
 5. Utility shelving.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:
1. Southern Pine
- C. Utility Shelving: Lumber with 19 percent maximum moisture content of the following species and grades:
1. Southern Pine
- D. Concealed Boards: 19 percent maximum moisture content and the following species and grades:
1. Southern Pine; Construction or No. 2 Common grade
- E. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.
- F. 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.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- 2.5 FASTENERS
- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
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 F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- 2.6 METAL FRAMING ANCHORS
- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Simpson Strong-Tie Co., Inc.
- B. Joist tie straps to be as indicated in structural drawings.
- C. Rafter tie straps to be as indicated in structural drawings.
- D. Hold-Downs to be as indicated in structural drawings.
- E. Materials: Unless otherwise indicated, fabricate from the following materials:
1. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
 - a. Use for interior locations unless otherwise indicated.
 2. Heavy-Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - a. Use for wood-preservative-treated lumber and where indicated.
 3. Stainless steel bars and shapes complying with ASTM A276/A276M, Type 304.
 - a. Use for exterior locations and where indicated.
- 2.7 MISCELLANEOUS MATERIALS
- A. Sill-Sealer Gaskets:

1. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. 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.
- G. Sort and select lumber so that natural characteristics do 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 AWPAC 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. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
- J. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.
- K. 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 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for 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 wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

3.3 INSTALLATION OF WALL AND PARTITION FRAMING

- A. General: Provide single bottom plate and double top plates using members of 2-inch

nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.

1. Provide continuous horizontal blocking at third points of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
 2. For exterior walls, provide jamb studs and headers as indicated on structural drawings.

3.4 INSTALLATION OF FLOOR JOIST FRAMING

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal. Attach floor joists as follows:
 1. Where supported on wood members, by using metal framing anchors.
 2. Where framed into wood supporting members, by using wood ledgers by using metal joist hangers.
- B. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.
- C. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.
- D. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.
- E. Provide solid blocking between joists under jamb studs for openings.
- F. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
 1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- G. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.
 1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal-size lumber, double-crossed and nailed at both ends to joists.
 2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.5 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

- A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
- B. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

END OF SECTION 06 10 00

SECTION 06 15 16 - WOOD ROOF DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-sawn wood roof decking.
- 2.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for dimension lumber items associated with wood roof decking.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For preservative-treated wood products, include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

B. Samples: 24 inches long, showing the range of variation to be expected in appearance of wood roof decking.

1.3 INFORMATIONAL SUBMITTALS

1.4 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery of wood roof decking to avoid extended on-site storage and to avoid delaying the Work.

B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Stack wood roof decking with surfaces that are to be exposed in the final Work protected from exposure to sunlight.

PART 2 - PRODUCTS

2.1 WOOD ROOF DECKING, GENERAL

- A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

2.2 SOLID-SAWN WOOD ROOF DECKING

- A. Standard for Solid-Sawn Wood Roof Decking: Comply with AITC 112.
- B. Roof Decking Species:
 - 1. Southern pine.
- C. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that are not exposed to view.
- D. Moisture Content: Provide wood roof decking with 15 percent maximum moisture content at time of dressing.
- E. Face Surface: Rough sanded or wire brushed.
- F. Edge Pattern: Vee grooved.

2.3 PRESERVATIVE TREATMENT

- A. Pressure treat wood roof decking in accordance with AWP A U1; Use Category UC2.
 - 1. For laminated roof decking, treat lumber before gluing.
- B. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 1. For exposed items indicated to receive a stained or natural finish, use products that do not contain colorants, bleed through, or otherwise adversely affect finishes.
- C. Use process that does not include water repellents or other substances that might interfere with application of indicated finishes.
- D. After treatment, redry materials to 15 percent maximum moisture content.

2.4 ACCESSORY MATERIALS

- A. Fasteners for Solid-Sawn Roof Decking: Provide fastener size and type complying with AITC 112 for thickness of deck used.
- B. Nails: Common; complying with ASTM F1667, Type I, Style 10.
- C. Fastener Material: Hot-dip galvanized steel.
- D. Bolts for Anchoring Roof Decking to Walls: Carbon steel; complying with ASTM A307 with ASTM A563 hex nuts and, where indicated, flat washers, all hot-dip zinc coated.
- E. Installation Adhesive: For glued-laminated wood roof decking indicated to be of diaphragm design and construction, provide adhesive that complies with research/evaluation report.
- F. Sealants: Latex, complying with applicable requirements in Section 07 92 00 "Joint Sealants" and recommended by sealant manufacturer and manufacturer of substrates for intended application.
- G. Penetrating Sealer: Clear sanding sealer complying with Section 09 93 00 "Staining and Transparent Finishing" and compatible with topcoats specified for use over it.

2.5 FABRICATION

- A. Shop Fabrication: Where preservative-treated roof decking is indicated, complete cutting, trimming, surfacing, and sanding before treating.
- B. Seal Coat: After fabricating and surfacing roof decking, apply a saturation coat of penetrating sealer.
- C. Apply indicated finish materials to comply with Section 09 93 00 "Staining and Transparent Finishing" in fabrication shop.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and support framing in areas to receive wood roof decking for compliance with installation tolerances and other conditions affecting performance of wood roof decking.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install solid-sawn wood roof decking to comply with AITC 112.
 - 1. Locate end joints for combination simple and two-span continuous lay-up
 - a. Use 12d nails for 2-by-6 and 2-by-8 roof decking.
- B. Anchor wood roof decking, where supported on walls, with bolts as indicated.
- C. Where preservative-treated roof decking must be cut during erection, apply a field-treatment preservative to comply with AWWPA M4.
 - 1. For solid-sawn roof decking, use
- D. Apply joint sealant to seal roof decking at exterior walls at the following locations:
 - 1. Between roof decking and supports located at exterior walls.
 - 2. Between roof decking and exterior walls that butt against underside of roof decking.
 - 3. Between tongues and grooves of roof decking over exterior walls and supports at exterior walls.

3.3 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged roof decking if repairs are not approved by Architect.

3.4 PROTECTION

- A. Provide water-resistive barrier over roof decking as the Work progresses to protect roof decking until roofing is applied.
- B. If, despite protection, roof decking becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 15 16

SECTION 06 15 33 - WOOD PATIO DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood decking.
2. Wood stair treads.
3. Wood railings.

B. Related Requirements:

1. Section 07 25 00 "Weather Barriers" for flexible flashing used with patio decking.
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for sheet metal flashing used with patio decking.

1.2 DEFINITIONS

- A. Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width. 5/4 x 6 boards
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 6 inches nominal in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 1. SPIB: The Southern Pine Inspection Bureau.

1.3 ACTION SUBMITTALS

A. Product Data: For preservative-treated wood products

1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.
 2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.
- C. Evaluation Reports: For the following, from ICC-ES:
1. Preservative-treated wood products.
 2. Plastic decking.
 3. Expansion anchors.
 4. Decking fasteners.

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Handle and store plastic lumber to comply with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.
1. Factory mark each item with grade stamp of grading agency.
 2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece
 3. 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 wood products.
 4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent
3. Timber: 19 percent

2.2 WOOD DECKING

A. Radius-Edged Board Decking: 1-1/4-inch actual thickness of the following species and grades:

1. Southern pine, Standard; SPIB.

B. S4S Board Decking: 1-1/4-inch

1. Species: Southern Pine
2. Grade Characteristics:
 - a. Clear small pin knots and worm holes allowed on back face.
 - b. All heart one face.
 - c. Straight grained and parallel cut.
 - d. Free of heart centers.
 - e. No decay, incipient decay, honeycomb, knot holes, shakes, splits, or wane.
 - f. No discoloration.

2.3 WOOD STAIR TREADS

A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.

B. Radius-Edged Board Stair Treads: 1-1/4-inch

1. Southern pine, Standard; SPIB.

C. Half-Round or Rounded-Edged Nosing Board Stair Treads: 1-1/4-inch

1. Southern pine, Edge Grain B & B stepping; SPIB.

D. S4S Board Stair Treads: 1-1/4-inch actual thickness radius-edged, with one face free of planer skip, machine burn, and torn or chipped grain.

1. Species: **Southern Pine**
2. Grade Characteristics:
 - a. Clear one face; small pin knots and worm holes allowed on back face.
 - b.
 - c. All heart one face.
 - d. Straight grained and parallel cut.

- e. Free of heart centers.
- f. No decay, incipient decay, honeycomb, knot holes, shakes, splits, or wane.
- g. No discoloration.

2.4 WOOD RAILINGS

- A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.
- B. Dimension Lumber Railing Members:
 - 1. Construction or No. 2 grade and the following species:
 - a. Mixed southern pine; SPIB.
- C. Railing Boards:
 - 1. Southern pine, B & B finish; SPIB.
- D. Radius-Edged Railing Boards: same grade as decking
- E. Railings to be aluminum to match existing beach restrooms
 - 1. Secure to custom wood railing with galvanized screws and fasteners

2.5 DIMENSION LUMBER FRAMING

- A. Deck and Stair Framing:
 - 1. Construction or No. 2 grade and any of the following species:
 - a. Southern pine; SPIB.
 - b. Mixed southern pine; SPIB.

2.6 POSTS

- A. Dimension Lumber Posts: Construction or No. 2 grade and the following species:
 - 1. Mixed southern pine; SPIB.
- B. Timber Posts:
 - 1. Southern pine; No. 2; SPIB.

2.7 PRESERVATIVE-TREATED LUMBER

- A. Pressure treat boards and dimension lumber with waterborne preservative in accordance with AWP A U1; Use Category UC3b.

- B. Pressure treat timber with waterborne preservative in accordance with AWP A U1; Use Category UC4a.
- C. Pressure treat poles with waterborne preservative in accordance with AWP A U1; Use Category UC4a.
- D. Preservative Chemicals: Acceptable to authorities having jurisdiction.
 - 1. Do not use chemicals containing arsenic or chromium.
- E. Use process for boards and dimension lumber that includes water-repellent treatment.
- F. After treatment, redry boards dimension lumber timber and poles to 19 percent maximum moisture content.
- G. Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
 - 1. For items indicated to receive a stained or natural finish, mark each piece on surface that will not be exposed
- H. Application: Treat items indicated on Drawings and the following:
 - 1. Framing members less than 18 inches above grade.
 - 2. Sills and ledgers.
 - 3. Members in contact with masonry or concrete.
 - 4. Posts.
 - 5. Round wood poles.
 - 6. Decking.
 - 7. Stair treads.

2.8 PLASTIC DECKING

- A. Plastic Lumber, General: Products acceptable to authorities having jurisdiction with current model code evaluation reports that show compliance with building code in effect for Project for indicated type of construction.
 - 1. Allowable loads and spans, as documented in evaluation reports or in information referenced in evaluation reports, are not to be less than design loads and spans indicated.
- B. Composite Plastic Lumber: Solid shapes made from a mixture of cellulose fiber and polyethylene or polypropylene.
 - 1. Decking Standard: ICC-ES AC109 or ICC-ES AC174.
 - 2. Decking Size: 1-1/4 by 6 nominal, 1 by 5-1/2 inches actual.
 - 3. Configuration: Provide product with grooved edges designed for fastening with concealed decking fasteners.

4. Surface Texture: Manufacturer's standard.
5. Color: As selected by Architect from manufacturer's full range.

2.9 FASTENERS

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate. All fasteners to be galvanized steel.
 1. Use fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329 unless otherwise indicated.
 2. For pressure-preservative-treated wood, use stainless steel fasteners.
 3. For plastic decking, use stainless steel fasteners.
- B. Nails: ASTM F1667.
- C. Power-Driven Fasteners: ICC-ES AC70.
- D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.
- E. Carbon-Steel Bolts: ASTM A307 with ASTM A563 hex nuts and, where indicated, flat washers all hot-dip zinc coated.

2.10 METAL FRAMING ANCHORS

- A. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G185 coating designation.
- C. Joist Hangers: U-shaped, with 2-inch-long seat and 1-1/4-inch-wide nailing flanges at least 85 percent of joist depth.
 1. Thickness: 0.062 inch.
- D. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
 1. Strap Width: 2 inches.
 2. Thickness: 0.062 inch.

- E. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch-minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.
- F. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
 - 1. Width: 1-1/4 inches.
 - 2. Thickness: 0.062 inch.
 - 3. Length: As indicated.

2.11 CONCEALED DECKING FASTENERS

- A. Deck Clips: Black-oxide-coated, stainless steel clips designed to be fastened to deck framing with screws, and to secure decking material with teeth that also provide uniform spacing of decking material.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prime wood indicated to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Section 09 91 13 "Exterior Painting."

3.3 INSTALLATION, GENERAL

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.
- B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.
- C. Install wood decking and stair treads with crown up (bark side down).
- D. Secure decking to framing with deck clips.

- E. Install metal framing anchors to comply with manufacturer's written instructions.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. ICC-ES AC70 for power-driven fasteners.
 - 2. "Fastening Schedule" in ICC's International Building Code.
- J. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.
- K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

3.4 INSTALLATION OF ELEVATED DECK JOIST FRAMING

- A. General: Install joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists where framed into wood supporting members by using wood ledgers as indicated or, if not indicated, by using metal joist hangers. Do not notch joists.
- B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.
- C. Lap members framing from opposite sides of beams or girders not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.
- D. Provide solid blocking of 2-inch nominal thickness by depth of joist at intervals of 96 inches o.c., between joists.

3.5 INSTALLATION OF STAIRS

- A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:

1. Stringer Size: 2 by 12 inches nominal, minimum.
 2. Notching: Notch stringers to receive treads, risers, and supports; leave at least 3-1/2 inches of effective depth.
 3. Stringer Spacing: At least three stringers for each 36-inch clear width of stair.
- B. Provide stair framing with no more than 3/16-inch variation between adjacent treads and risers and no more than 3/8-inch variation between largest and smallest treads and risers within each flight.
- C. Treads and Risers: Secure by gluing and screwing to carriages. Countersink fastener heads, fill flush, and sand filler. Extend treads over carriages and finish with bullnose edge.

3.6 INSTALLATION OF RAILINGS

- A. Balusters: Fit to railings, screw in place. Countersink fastener heads, fill flush, and sand filler.
- B. Newel Posts: Secure to stringers and risers with through bolts.
- C. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts.

END OF SECTION 06 15 33

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Composite nail base insulated roof sheathing.
4. Subflooring and underlayment.
5. Sheathing joint-and-penetration treatment materials.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for plywood backing panels.
2. Section 07 25 00 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Wall sheathing.
2. Roof sheathing.
3. Subflooring and underlayment.
4. Sheathing joint-and-penetration treatment materials.

B. Product Data Submittals: 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 plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.

4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 1. Wood-preserved-treated plywood.
 2. Fire-retardant-treated plywood.
- B. Field quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 WOOD PANEL PRODUCTS

- A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- B. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2[for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground].
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

- C. Application: Treat all plywood unless otherwise indicated and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 WALL SHEATHING

- A. Plywood Sheathing, Walls: Either DOC PS 1 or DOC PS 2, Exterior, Structural I sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: Not less than 1/2 inch.

2.5 ROOF SHEATHING

- A. Plywood Sheathing, Roofs: Either DOC PS 1 or DOC PS 2, Exterior, Structural I sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: Not less than 1/2 inch.

2.6 SUBFLOORING AND UNDERLAYMENT

- A. Plywood Subflooring: Either DOC PS 1 or DOC PS 2, Exterior, Structural I single-floor panels or sheathing.
 - 1. Span Rating: Not less than 16.
 - 2. Nominal Thickness: Not less than 7/8 inch.
- B. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch over smooth subfloors and not less than 3/8 inch over board or uneven subfloors.
 - 1. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch nominal thickness.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
 - 2. For roof and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours in accordance with ASTM B117.

- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.
- E. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours in accordance with ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Paper-Surfaced and Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Use common wire 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. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF WOOD STRUCTURAL PANEL

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Combination Subfloor-Underlayment:
 - a. Nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.
 - 2. Subflooring:
 - a. Nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.
 - 3. Wall and Roof Sheathing:
 - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.
 - 4. Underlayment:
 - a. Nail to subflooring.
 - b. Space panels 1/32 inch apart at edges and ends.

END OF SECTION 06 16 00

SECTION 06 17 15 - ENGINEERED STRUCTURAL WOOD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural composite lumber.

B. Related Requirements:

1. for dimension lumber items associated with engineered structural wood.
2. Section 06 17 53 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on adhesives, fabrication, and protection.
2. For preservative-treated wood products, include manufacturer's written instructions for handling, storing, installing, and finishing treated material.
3. For connectors, include installation instructions.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For preservative-treated wood products, from manufacturer. Indicate type of preservative used and net amount of preservative retained.

B. Research Reports: For engineered structural wood, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store, stack, and handle engineered wood products to comply with recommendations of APA EWS E705.

1. Store wrapped or banded together until ready for installation, on level well-drained area. Do not store in direct contact with the ground. Use stickers to separate bundles, spaced as recommended in writing by manufacturer.

B. Do not stack other material on top of structural composite lumber or I-joists.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of engineered wood product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable design stresses, as published by manufacturer, are to meet or exceed those indicated. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.3 STRUCTURAL COMPOSITE LUMBER

- A. Parallel-Strand Lumber (PSL): Preservative-treated, structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored in accordance with ASTM D5456, and manufactured with exterior-type adhesive complying with ASTM D2559.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Weyerhaeuser Company
 - 2. Allowable Stresses:
 - a. Extreme Fiber Stress in Bending, Edgewise (Fb): As Indicated in Drawings.
 - b. Modulus of Elasticity, Edgewise (E): As Indicated in Drawings.
 - c. Minimum Modulus of Elasticity (Em): As Indicated in Drawings.
 - d. Horizontal Shear (Fv): As Indicated in Drawings.
 - e. Tension Parallel to Grain (Ft): As Indicated in Drawings.
 - f. Allowable Compression Stress, Parallel to the Grain (Fc): As Indicated in Drawings.
 - 3. manufacturer's standard water-resistant coating.

2.4 PRESERVATIVE TREATMENT

- A. Description: Preservative treatment; AWPAC U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3B for exterior construction not in contact with ground, and Use Category UC4A for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

2.5 FASTENERS

- A. General: Fasteners are to be of size and type indicated and to comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.
- E. Carbon Steel Bolts: ASTM A307 with ASTM A563 hex nuts and, where indicated, flat washers all hot-dip zinc coated.
- F. Stainless Steel Bolts: ASTM F593, Alloy Group 1 or 2; with ASTM F594, Alloy Group 1 or 2 hex nuts and, where indicated, flat washers.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Do not install in direct contact with concrete or masonry.
- B. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 1. Use treatment approved in writing by manufacturer.

3.3 INSTALLATION OF STRUCTURAL COMPOSITE LUMBER

- A. Install to comply with ESR report, manufacturer's written instructions, and applicable code.
 1. Install metal framing connections in accordance with AWC's "National Design Specification (NDS) for Wood Construction." Install fasteners through each

fastener hole.

- a. Connections based on NDS or manufacturer's test or code reports.
 - 2. Install lumber plumb and level. Accurately fit, align, securely fasten, and install free from distortion or defects.
 - 3. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
- B. Cutting: Confirm size and location of field cutting, notching, and drilling with ESR report, registered design professional, and manufacturer.

END OF SECTION 06 17 15

SECTION 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Preservative-treated lumber.

1.2 ALLOWANCES

- ##### A. Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance.

1.3 DEFINITIONS

- ##### A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 ACTION SUBMITTALS

- ##### A. Product Data: For wood-preservative-treated lumber, metal-plate connectors, metal truss accessories, and fasteners.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification from 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 truss fabricator.

- ##### B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
5. Show splice details and bearing details.

- ##### C. Delegated Design Submittals: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- ##### A. Qualification Data: For metal connector-plate manufacturer and fabricator.
- ##### B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- ##### C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

1.6 QUALITY ASSURANCE

- ##### A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive

engineering analysis by a qualified professional engineer.

- B. Fabricator Qualifications: Shop that is certified for chain of custody by an FSC-accredited certification body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses are to be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
 - 1. Design Loads: As indicated.
 - 2. Maximum Deflection under Design Loads:
 - a. Roof Trusses: Vertical deflection of 1/240 of span.
- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 WOOD PRODUCTS

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (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. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S.
 - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 00 "Rough Carpentry."
- C. Both top and bottom chords of roof trusses are to be a minimum nominal chord size of 2x8.

2.3 PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A 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.
 - 2. For exposed trusses indicated to receive a stained or natural finish, use chemical

formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or 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.
 - 1. For exposed trusses indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.
 - D. Application: Treat all trusses unless otherwise indicated.
- 2.4 FASTENERS
- A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 - 2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
 - B. Nails, Brads, and Staples: ASTM F1667.
- 2.5 MISCELLANEOUS MATERIALS
- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.
- 2.6 FABRICATION
- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
 - B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
 - C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
 - D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.
- 2.7 SOURCE QUALITY CONTROL
- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
 - 1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
 - 2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.
 - B. Correct deficiencies in Work that special inspections indicate do not comply with the Contract Documents.
- PART 3 - EXECUTION
- 3.1 INSTALLATION
- A. Install wood trusses only after supporting construction is in place and is braced and secured.
 - B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
 - C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required,

exercising care not to damage truss members or joints by out-of-plane bending or other causes.

- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 06 10 00 "Rough Carpentry."
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- L. Replace wood trusses that are damaged or do not comply with requirements.
 - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND 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 wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. Repair damaged galvanized coatings on exposed surfaces in accordance with ASTM A780/A780M and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

END OF SECTION 06 17 53

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1.
2. Factory-laminated plastic sheet paneling.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring for installing plastic paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

A. Testing Agency: Acceptable to authorities having jurisdiction

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.

1. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
2. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
3. Surface Finish: Smooth.
4. Color: White.

2.3 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard two-piece, snap-on vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 1. Color: Match panels
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Adhesive: As recommended by plastic paneling manufacturer.
- E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- B. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

- C. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels
 - 1. Mark plumb lines on substrate at trim accessory or **panel joint** locations for accurate installation.
 - 2. Locate trim accessories and **panel joints** to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 - 1. Drill oversized fastener holes in panels and center fasteners in holes.
 - 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with adhesive or nails.
- F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyisocyanurate foam-plastic board insulation.

B. Related Requirements:

1. Section 07 41 13 "Standing-Seam Metal Roof Panels" for insulation specified as part of roofing construction.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
2. Sign, date, and post the certification in a conspicuous location on Project site.

- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

- C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.
- B. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- C. Thermal-Resistance Value (R-Value): R-6 per inch in accordance with ASTM C518.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville; a Berkshire Hathaway company; AP Foil-Faced Foam Sheathing or a comparable product.

2.3 INSULATION FASTENERS

- A. Fasten insulation using 1-inch head plastic cap nails long enough to penetrate framing at least 3/4 inch, or 3/8-inch head galvanized roofing nails long enough to penetrate at least 3/4-inch, or 1-inch crown 16-gauge wire staples long enough to penetrate at least 1/2-inch. Drive fasteners flush with board, but do not countersink. Space fasteners in the perimeter and in the field of the board consistent with the framing, but not greater than 24 inches.
- B. Insulation Fastener Accessories: Provide double-pointed weld pins, lagging pins, quilting pins, duct liner pins, insulation hangers, specialty washers, special caps, j-hooks, capacitor discharge annular weld pins, capacitor discharge acoustical lagging pins, and other accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.

2.4 ACCESSORIES

- A. Miscellaneous Application Accessories:
 - 1. Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.
 - 2. Tapes for Reflective Insulation and Barriers:
 - a. Aluminum-foil tape for repairs or splicing material.
 - b. Reinforced-foil tape for sealing tears or cuts in sheet vapor barrier.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.
- 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. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF BOARD INSULATION

- A. Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.

3.4 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. 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

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wrap.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

B. Product Data Submittals: For building wrap, include data on air and water-vapor permeance based on testing in accordance with referenced standards.

C. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, certified, or licensed by the weather barrier system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

1.5 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.

1.6 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written installation instructions and warranty requirements.

1.7 WARRANTY

- A. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WEATHER BARRIERS

- A. Building Wrap: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84; UV stabilized; and acceptable to authorities having jurisdiction.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont de Nemours, Inc.; DuPont Tyvek CommercialWrap or a comparable product.
 - 2. Building Wrap Type: Type I, ASTM E1677.
 - 3. Composition Type: Nonperforated, nonwoven polyolefin.
 - 4. Water-Vapor Permeance: Minimum 20 perms in accordance with ASTM E96, Desiccant Method (Procedure A).
 - 5. Air Permeance: Not more than 0.001 cfm/sq. ft. at 1.57 lbf/sq. ft. when tested in accordance with ASTM E2178.
 - 6. Allowable UV Exposure Time: Not more than 270 days.

2.2 ACCESSORY MATERIALS

- A. Requirement: Provide primers, fasteners, seam tapes, flashing, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by weather barrier manufacturer to produce a complete weather barrier assembly and that are compatible with primary weather barrier material and adjacent construction to which they may seal.

PART 3 - EXECUTION

3.1 INSTALLATION OF WEATHER BARRIERS

- A. Weather Barriers:

1. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
 2. Drainage Material: Comply with manufacturer's written instructions.
- B. Install weather barrier accessories for a complete installation with weather barriers in accordance with manufacturers written instructions.

END OF SECTION 07 25 00

SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vertical-rib, seamed-joint, standing-seam metal roof panels. Ensure weather tightness per chapter 15 of Florida Building Code.
2. Substrate board – Plywood or Perlite?
3. Vapor barrier
4. Roof insulation.
5. Cover board.
6. Tongue and Groove
7. Underlayment.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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

1.3 ACTION SUBMITTALS

A. Product Data:

1. For standing-seam metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: Manufacturer's standard color charts, showing full range of available colors for each type of exposed finish.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish for metal panels and metal panel accessories.

1. Size: Manufacturers' standard size.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For standing-seam metal roof panels, for tests performed by a qualified testing agency.

B. Field quality-control reports.

C. Qualification Statements: For roof installers.

D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels.

1.6 QUALITY ASSURANCE

A. Roof Installer Qualifications: Entity that employs [a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified Metal Panel Roof Systems Installers] [a supervisor who is an NRCA ProCertified Roofing Foreman]

[a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified Metal Panel Roof Systems Installers].

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

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

1.9 COORDINATION

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

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including rupturing, cracking, or puncturing.

- b. Deterioration of metal and other materials beyond normal weathering.
- 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 10 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
 - 4. .
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E1680 at the following test-pressure difference:
- C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E1646 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- D. Watertightness: No water penetration when tested in accordance with ASTM E2140 for hydrostatic-head resistance.

- E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- F. FM Approvals Listing: Provide metal roof panels and component materials that comply with requirements in FM Approvals 4471 as part of a panel roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
 - 1. Fire/Windstorm Classification: Class 1A- 120.
 - 2. Hail Resistance: SH.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- H. Energy Performance:
 - 1. Provide roof panels in accordance with one of the following when tested in accordance with CRRC-1:
 - a. Three-year, aged solar reflectance of not less than 0.55 and emissivity of not less than 0.75.
 - b. Three-year, aged Solar Reflectance Index (SRI) of not less than 64 when calculated in accordance with ASTM E1980.

2.2 STANDING-SEAM METAL ROOF PANELS, GENERAL

- A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed fasteners in side laps. Include all accessories required for weathertight installation.
 - 1. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1637.

2.3 VERTICAL-RIB, SEAMED-JOINT, STANDING-SEAM METAL ROOF PANELS

- A. Panels: Formed with vertical ribs at panel edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
 - 1. Structural Support: Over solid deck.
 - 2. Material: Aluminum

3. Seam Type: Manufacturer's standard.
4. Panel Profile: 18 inches
5. Panel Height: 1.5 inches
6. Clips: Two piece, floating, designed to accommodate thermal movement.
 - a. Steel Clips: 20ga. zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - b. Clip Spacing: As indicated on approved Shop Drawings.

2.4 SUBSTRATE BOARD

- A. Structural Plywood: ASTM C728, seal coated.
 1. Thickness: 3/4 inch
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions for fastening substrate panel to roof deck.

2.5 VAPOR BARRIER

- A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.6 ROOF INSULATION

- A. Insulation over Solid Deck:
 1. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - a. Compressive Strength: 25 psi.
 - b. Size: 48 by 48 inches.
 - c. Thickness:
 - 1) Base Layer: 1-1/2 inches.
 - 2) Upper Layer: as need to achieve R value required.

2.7 COVER BOARD

- A. Oriented Strand Board: DOC PS 2, Exposure 1, 7/16 inch thick.

2.8 UNDERLAYMENT

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970/D1970M.
 - 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970/D1970M.
- B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.9 PANEL MATERIALS

- A. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - 1. Thickness: 0.040 inch.
 - 2. Surface: Smooth, flat finish.
 - 3. Prepatinated Color: as selected from manufacturer's standard colors.

2.10 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, minimum ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 coating designation. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, fasteners, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.11 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

***** [OR] *****

- B. On-site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate in accordance with equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for other than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with manufacturer's recommendations.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not permitted on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by metal panel manufacturer for application, but not less than thickness of metal being secured.

2.12 FINISHES

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal panel manufacturer's written installation instructions.

3.3 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.
 1. Tightly butt substrate boards together.
 2. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 3. Fasten substrate board in accordance with roofing system manufacturers' written installation instructions.

3.4 INSTALLATION OF VAPOR BARRIER

- A. Loosely lay vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Continuously seal side and end laps with tape

3.5 INSTALLATION OF ROOF INSULATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, in accordance with manufacturer's written installation instructions.
 - 1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
 - 2. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
- B. Blanket Roof Insulation: Comply with the following installation method:
 - 1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.

3.6 INSTALLATION OF COVER BOARD

- A. Install cover board over insulation in accordance with manufacturer's written installation instructions. Install with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

3.7 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply over the entire roof surface.
 - 2. Apply over the entire roof surface.
- B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3.8 INSTALLATION OF STANDING-SEAM METAL ROOF PANELS

- A. Install metal panels in accordance with manufacturer's written installation instructions and approved Shop Drawings in orientation, sizes, and locations indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Concealed Clip, Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Install clips to supports with self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
 4. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommended in writing by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- F. Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions. Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- G. Pipe and Conduit Penetrations: Fasten and seal to metal roof panels as recommended by manufacturer.

3.9 ERECTION TOLERANCES

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

3.10 FIELD QUALITY CONTROL

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

3.11 CLEANING AND PROTECTION

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

END OF SECTION 07 41 13.16

SECTION 07 46 46 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fiber-cement siding.
2. Fiber-cement soffit.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 07 25 00 "Weather Barriers" for weather-resistive barriers.

1.2 COORDINATION

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

1.3 PREINSTALLATION MEETINGS

1.4 ACTION SUBMITTALS

A. Product Data:

1. Fiber-cement siding & trim.

- ##### B. Product Data Submittals: For each type of fiber-cement siding. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- ##### C. Samples for Initial Selection: For fiber-cement siding including related accessories.

- ##### D. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch-long-by-actual-width Sample of siding.
2. 12-inch-long-by-actual-width Samples of trim and accessories.

1.5 INFORMATIONAL SUBMITTALS

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

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of fiber-cement siding, including related accessories, to include in 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. Furnish full lengths of fiber-cement siding including related accessories, in a quantity equal to 2 percent of amount installed.

1.8 DELIVERY, STORAGE, AND HANDLING

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

1.9 WARRANTY

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

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

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

2.2 FIBER-CEMENT SIDING

- A. Fiber-Cement Siding: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. James Hardie Building Products, Inc.
- B. Labeling: Provide fiber-cement siding that is tested and labeled in accordance with ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Nominal Thickness: Not less than 5/16 inch.
- D. Horizontal Pattern: Boards 8-1/4 to 8-1/2 inches wide in [plain] style.
 - 1. Texture: Wood grain.
- E. Factory Priming: Manufacturer's standard acrylic primer.

2.3 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
 - 1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
 - 1. Corner posts.
 - 2. Door and window casings.
 - 3. Fasciae.
 - 4. Moldings and trim.

5. .

C. Flashing: Provide aluminum flashing complying with Section 07 62 00 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: High-performance organic finish.

D. Fasteners:

1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch into substrate.

2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.

3. For fastening fiber cement, use hot-dip galvanized fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.

2. Install fasteners no more than 24 inches o.c.

B. Install joint sealants as specified in Section 07 92 00 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 46

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Custom flashing and trim fabrications, made from the following:
 - 1. Sheet metal materials.
 - 2. Miscellaneous materials.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 074113.16 "Standing-Seam Metal Roof Panels" for materials and installation of sheet metal flashing and trim integral with roofing.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Plans, elevations, sections, and attachment details.
 - 2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
 - 3. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 4. Details for forming, including profiles, shapes, seams, and dimensions.
 - 5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 6. Details of termination points and assemblies.
 - 7. Details of roof-penetration flashing.
 - 8. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.

9. Details of special conditions.
10. Details of connections to adjoining work.
11. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.
- D. Qualification Statements: For fabricator.
- E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Entity 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. Installer Qualifications: Entity that employs a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified Architectural Metal Flashings and Accessories Installers.
- C. For roof edge flashings and copings that are ANSI/SPRI/FM 4435/ES-1 tested, shop is to be listed as able to fabricate required details as tested and approved.

1.7 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.
 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to 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 are not to rattle, leak, or loosen, and are to remain watertight.
- 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/or SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL MATERIALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 1. Surface: Smooth, flat.
 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 3. Color: As selected by Architect from manufacturer's full range.
 4. 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.

2.3 UNDERLAYMENT

- A. Self-Adhering, High-Temperature Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970/D1970M.
 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F or lower; ASTM D1970/D1970M.
- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as 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 screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Zinc-Coated (Galvanized) hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
1. 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's lower edge.
 2. Finish: With manufacturer's standard color coating.

2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 2. 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.
 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application. Cleats must be at least one gauge heavier than fascia metal.
- G. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Do not use graphite pencils to mark metal surfaces.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.
- B. Valley Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.
- C. Drip Edges: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.
- D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.022 inch thick.
 2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

- E. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
 - 2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.
- F. Flashing Receivers: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch thick.
 - 2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.
- G. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.
 - 2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.
 - 2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, 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.
 - 3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.

4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
 5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
 6. Roll laps and edges with roller.
 7. Cover underlayment within 14 days.
- B. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.
1. Install in shingle fashion to shed water.
 2. Lapp joints not less than 4 inches.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
 6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 8. Do not field cut sheet metal flashing and trim by torch.
 9. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

- A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
 1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing:
 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
- C. Copings:
 1. Install copings in accordance with ANSI/SPRI/FM 4435/ES-1.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
 1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 2. Extend counterflashing 4 inches over base flashing.
 3. Lap counterflashing joints minimum of 4 inches.

4. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with appropriate sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL SHEET METAL FABRICATIONS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.6 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing:
 1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
 2. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 INSTALLATION TOLERANCES

- A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING

- A. Clean and neutralize flux materials. Clean off excess solder.
- B. Clean off excess sealants.

3.9 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in 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, as determined by Architect.

END OF SECTION 076200

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

A. Product Data:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.

- B. Samples for Initial Selection: Manufacturer's standard 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 type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
 - 1. Joint-sealant location and designation.
 - 2. Manufacturer and product name.
 - 3. Type of substrate material.
 - 4. Proposed test.
 - 5. Number of samples required.
- B. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested 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 are needed for adhesion.
- C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- D. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.
- E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Manufacturers' special warranties.
- B. Installer's special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.

1.8 FIELD CONDITIONS

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

1.9 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

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

2.3 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

2.4 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

2.6 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

2.7 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Unglazed surfaces of ceramic tile.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 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 in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - a. Extent of Testing: Test completed and cured sealant joints as follows:
 - 1) Perform 10 tests for the first [1000 ft.] <Insert dimension> of joint length for each kind of sealant and joint substrate.
 - b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - c. Inspect tested joints and report on the following:
 - 1) Whether sealants filled joint cavities and are free of voids.
 - 2) Whether sealant dimensions and configurations comply with specified requirements.
 - 3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull

distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

- d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 - e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- C. Prepare test and inspection reports.

3.5 CLEANING

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

3.6 PROTECTION

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

END OF SECTION 07 92 00

SECTION 082200 - FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass Reinforced Plastic (FRP) Doors
- B. Fiberglass Reinforced Plastic (FRP) Frames

1.2 RELATED SECTIONS

- A. Division 1 - General Conditions, Supplementary Conditions
- B. Division 8 - Finish Hardware

1.3 QUALITY ASSURANCE

A. General Qualifications:

- 1. Manufacturer Qualifications: A company that specializes in manufacturing FRP doors and frames with a minimum of 30 years' experience.
- 2. Quality Assurance: Obtain all FRP doors and FRP frames from a single manufacturer to ensure consistent quality.
- 3. Quality Assurance: Hardware and accessories for all FRP doors and FRP frames shall exactly adhere to the Architect's specification.
- 4. Quality Assurance: Glass for windows in doors shall be furnished per the Architect's instructions and specifications.

B. Regulatory Requirements:

- 1. Install doors, panels and frames conforming to NFPA 80 for fire-rated class, ANSI A117.1 specifications for handicap accessibility, ADA requirements, ANSI A250.4-2011 cycle swing in excess of 1,000,000 cycles with no failure of any design features of the door.
- 2. Flame Spread: All rated FRP component parts, including the finish, shall have a flame spread classification of 25 or less per ASTM E84 and shall be self-extinguishing per ASTM D635, unless operating conditions dictate otherwise.
- 3. Products manufactured—if so specified—that have passed the Florida Building Code (FBC), including Miami-Dade High Velocity Hurricane Zone (HVHZ).

C. Warranty:

To include ten (10) years free from defects in material and workmanship from date of shipment, and lifetime from corrosion from date of shipment, provided that the structural integrity of the doors and frames have not been violated or compromised.

1.4 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 0 1300.
- B. Shop Drawings – Include the following:
 - 1. Elevation of each door type including door size, handing and finish
 - 2. Cutout locations for lites and hardware
 - 3. Internal reinforcement
 - 4. Frame configuration, anchor types and spacing
- C. Product data including manufacturer's literature, fabrication descriptions and installation instructions.
- D. Construction and/or color samples as requested.

1.5 DELIVERY, STORAGE AND PROTECTION

- A. Doors and frames will be individually packaged in cardboard cartons. Cartons will be clearly labeled with project information and will include fasteners and installation instructions, if required. Only remove cartons upon arrival if cartons are wet or damaged.
- B. Deliver and store doors and frames at the job site in such a manner as to prevent damage; out of weather and/or extreme temperatures. The doors shall be stored in a vertical position on blocking, clear of the floor and with blocking between the doors to permit air circulation between the doors.
- C. All damaged or otherwise unsuitable doors and frames, when so ascertained, shall be immediately removed from job site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Products manufactured by the following companies complying with these specifications will be acceptable: CORRIM Company, Oshkosh, Wisconsin 54901. Phone: 920-231-2000
- B. Substitutions may be considered provided the manufacturer can comply with the specifications as written and the products are manufactured in the United States of America. Requests for substitutions must be submitted in writing no less than ten (10) business days prior to the bid date. Substitution requests shall include a physical sample and written documentation that the product meets the specific manufacturing methods as stated herein.

2.2 FRP DOORS

A. Door Fabrication:

1. Total door thickness to be a nominal 1-3/4 inches thick.
2. Lock stiles on non-rated and rated active leaves shall be factory beveled 1/8" in 2".
3. Provide doors with completely seamless construction on all six (6) surfaces.

B. Face Sheets:

FRP face sheets shall be manufactured using a corrosion resistant resin system with light stabilizing additives. The resin shall be reinforced with fiberglass, 50% average by weight for enhanced strength. Face sheets shall be a minimum of 0.125 inch thick fiberglass. Face sheets will be Architect's choice of smooth or pebble seamless finish.

C. Stiles and Rails:

Stiles and rails shall be 1-1/2 inch square pultruded fiberglass tubes. Pultrusion is a fiberglass fabrication process that results in a much stronger, more durable product. Non-rated and 20 minute doors will have a full width horizontal 1-1/2 inch square pultruded fiberglass tube every 24 inches in height for internal reinforcement. A 1-1/2 inch square solid fiberglass block shall be used at all hardware reinforcements and corner intersections. A minimum of 1,000 pounds screw withdrawal force shall be required per screw. The bottom rail shall allow for 1-1/4 inches of height alterability without loss of the panel's integrity. Absolutely no metal or wood reinforcements, including #2 SPF (Spruce Pine Fir), will be allowed in any part of the stile and rail configuration.

D. Core Options:

1. Polyurethane Foam Core: A 1-1/2 inch thick rigid block of polyurethane shall be laminated to the interior of the panels. The "R" factor shall be 12. The polyurethane insulation shall be Class A and CFC free. Foam properties comply with ASTM E-84 and The International Building Code (IBC).

***** [OR] *****

2. Balsa Core: 1-1/2 inches thick Balsa core, of end grain construction for enhanced strength, shall be laminated to the interior of the panels. The balsa shall have a density of 8.5 – 9.0 lbs cu. Ft. Compressive strength, perpendicular to the door panel surface shall be 1400 psi.

E. Hardware Preparations:

Doors shall be reinforced and mortised for hardware with 1-1/2 inches x 1-1/2 inches of solid fiberglass to allow application of hinges and locks, in accordance with the hardware schedule, hardware manufacturer's instructions and templates.

1. Reinforcement Blocking: Non-swelling polymer or firestop blocking will be used for all lockset, surface mounted hardware and through bolted hardware blocking.
2. Pilot holes for full mortise butt hinges will be pre-drilled by factory.

3. All hardware shall be attached / installed by using pilot hole and stainless steel wood screws.

2.3 FRP FRAMES

A. Fabrication:

FRP frames shall be rigid, neat in appearance, free from defects and the finish shall match the doors. Fabricate FRP doors and frames as shown on the drawings and in accordance with best shop practices. Field measurements shall be taken as required for coordinating with adjoining work.

1. Provide frames for doors, as required.
2. All frames shall be 100% pultruded fiberglass with an average 50% glass content by weight which results in an industrial fiberglass frame as strong as a 14 gauge hollow metal frame.
3. Non-rated and 20 minute UL labeled: Standard one piece FRP profile with integral stop: 5-3/4" x 2" equal rabbet (optional: 4 inch header, modified depth with equal rabbet, modified depth with un-equal rabbet, single rabbet design)
4. Head and jamb members shall be standard 45 degree miter, providing a neatly mitered corner connection, fabricated for Knocked Down (KD) field assembly. (optional: one piece frame, resin bonded and assembled at factory, available on non-rated frames only)

B. Reinforcements and Braces / Supports

1. Frames shall be reinforced and mortised for hardware in accordance with the hardware schedule, manufacturer's instructions and templates. Absolutely no metal reinforcements will be allowed in any part of the FRP frame configuration.
2. Corner Reinforcement: 4 inches x 4 inches x 5-3/8 inches x 1/4 inch thick pultruded fiberglass angle. Attached to head bar at factory using stainless steel screws.
3. Mortise Hinge Reinforcement: 3 inches x 7 inches x 9/16 inch (or 3/8 inch) thick FRP material attached to frame by means of bonding and stainless steel countersunk screws.
4. Closer Reinforcement: 1-1/2 inches x 19 inches x 3/16 inch thick FRP material attached to frame by means of bonding.
5. Strike Reinforcement: 1-1/2 inches x 9 inches x 3/4 inch thick FRP material attached to frame by means of bonding and stainless steel countersunk screws.
6. Anchoring Systems: Furnish at least three (3) anchors in each jamb of frames up to 90 inches high and one (1) additional anchor for each 30 inches in height above 90 inches, in shapes, sizes and spacing shown or required for anchorage into adjoining wall construction.
 - a. New Stud (before sheathing): New Stud Anchor

2.4 FINISH

- A. Polyurethane finish, high solids polyurethane topcoat that exhibits excellent chemical resistance, outstanding toughness, flexibility, abrasion resistance and excellent outside durability.
 - 1. Flat; smooth face sheets only.
 - 2. Semi-Gloss; all face sheet options.
 - 3. Gloss; smooth or pebble face sheets only.
- B. Gelcoat Matte Finish, 25 mil (smooth face sheets only), from manufactures full range of colors.
- C. Prime; finish for field painting, all face sheet options.
 - 1. Acceptable top coatings
 - a. Enamel
 - b. Alkyd
 - c. Polyurethane
 - d. Latex
 - e. Epoxy
- D. Finish on door and frame units will match

PART 3 - EXECUTION

3.1 INSPECTION

Installer shall examine the substrate and conditions under which fiberglass reinforced plastic work is to be installed and notify the General Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 INSTALLATION

- A. Doors and frames will be delivered in individual cartons with the identifying mark number listed on each carton.
- B. Install FRP doors, frames and accessories in accordance with manufacturers printed instructions, final shop drawings, NFPA 80 standards at fire rated openings and / or HVHZ standards for FBC-labelled openings.
- C. Provide clearance for doors of 1/8 inch at jambs and heads; 1/4 inch clearance above threshold.

3.3 ADJUSTING

At substantial completion, adjust all operable components to ensure proper installation. Doors shall function smoothly and swing freely without binding. Doors shall remain open at any angle without being affected by gravitational influence.

3.4 CLEANING

Remove dirt and excess sealant from exposed surfaces. Follow the manufacturer's recommended cleaning techniques and procedures for cleaning all surfaces. Only use cleaning products that will not scratch or damage the surfaces and are recommended by the manufacturer.

PART 4 - MATERIAL PROPERTIES OF FIBER REINFORCED PLASTIC (FRP) PROFILES

4.1 DOOR PROPERTIES

ASTM D-256:	Notched Izod Impact
ASTM D-638:	Tensile Strength Properties of Plastic
ASTM D-695:	Compressive Strength
ASTM D-732:	Shear Strength
ASTM D-790:	Flexural Strength / Flexural Modulus
ASTM D-2583:	Barcol Hardness
ASTM E-283:	Air Infiltration Test
ASTM E-330:	Static Load Test
ASTM E-331:	Water Infiltration
ASTM E-1886:	Impact by Missiles & Exposed to Cyclic Pressure Differentials
ASTM E-1996:	Impact by Wind Borne Debris
TAS 201:	Large Missile Impact
TAS 202:	Static Load Test
TAS 203:	Cyclic Load Test
SFBC 3603.2:	Forced Entry

4.2 FOAM CORE PROPERTIES

ASTM C-203:	Flexural Modulus
ASTM C-272:	Water Absorption
ASTM C-273:	Shear Strength
ASTM C-518:	K-Factor / R-Factor
ASTM D-1621:	Compressive Modulus
ASTM D-1622:	Density
ASTM D-1623:	Tensile Strength
ASTM D-2126:	Dimensional Stability
ASTM D-2856:	Closed Cell Content
ASTM E-84:	Surface Burning Characteristics
ASTM E-96:	Water Vapor Permeability

4.3 BALSA CORE PROPERTIES

ASTM C-271:	Apparent Normal Density
ASTM C-273:	Shear Strength
ASTM C-297:	Tensile Strength
ASTM C-365:	Compressive Strength
ASTM D-177:	Thermal Conductivity
BSS-7238:	Smoke Density & Toxic Gas Generation
CMVSS/FMVSS 302:	Motor Vehicle Flammability Safety Test
MIL-STD-907B:	Fire Resistance Test

4.4 ADHESIVE PROPERTIES: URETHANE ADHESIVE SYSTEM

ASTM D-570:	Water Absorption
ASTM D-638:	Elongation Percent
ASTM D-638:	Tensile Strength

ASTM D-638:	Young's Modulus
ASTM D-2240:	Shore Hardness, D
ASTM D-3163:	Bond Configuration Lap Shear
ASTM E-132:	Poisson Ratio
ASTM E-1640:	Glass Transition Temperature
ISO MAT-2208:	CLTE@ -30 to 0 deg. C
ISO MAT-2208:	CLTE@ 50 to 100 deg. C
SAE J-1525:	Crosshead Speed

4.5 RESIN PROPERTIES

ASTM D-256:	Notched Izod Impact
ASTM D-570:	Water Absorption
ASTM D-638:	Tensile Strength Properties of Plastics
ASTM D-638:	Tensile Modulus
ASTM D-638:	Tensile Elongation @ Yield
ASTM D-648:	Heat Deflection Temperature
ASTM D-695:	Compressive Strength / Compressive Modulus
ASTM D-790:	Flexural Strength / Flexural Modulus
ASTM D-2566:	Linear Shrinkage
ASTM D-2583:	Barcol Hardness

END OF SECTION 082200

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hinges.Mortise locks.
2. Push-pull latches.
3. Mortise auxiliary locks.
4. Exit devices and auxiliary items.
5. Lock cylinders.
6. Surface closers.
7. Wall- and floor-mounted stops.
- 8.
9. Door gasketing.
10. Thresholds.
11. Metal protective trim units.
12. Auxiliary door hardware.

1.2 COORDINATION

- ##### A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Hinges.
2. Mortise locks.
3. Push-pull latches.
4. Mortise auxiliary locks.
5. Exit devices and auxiliary items.
6. Lock cylinders.
7. Surface closers.
- 8.
- 9.
10. Wall- and floor-mounted stops.
- 11.
12. Door gasketing.

13. Thresholds.
 14. Metal protective trim units.
 15. Auxiliary door hardware.
 16. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Data Submittals: For each product.
- C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of product data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
 3. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
- D. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Architectural Hardware Consultant.
- B. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lockup for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to Owner by registered mail or overnight package service.

1.8 WARRANTY

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

- a. Exit Devices: Two years from date of Substantial Completion.
- b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of door hardware from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- 1. Air-Leakage Rate: Maximum air leakage of 0.3 cfm per sq. ft. at the tested pressure differential of 0.3 inch wg of water.
- B. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design"
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 2. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 - 3. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.3 HINGES

- A. Hinges: ANSI/BHMA A156.1. Provide template-produced hinges for hinges installed on fiberglass doors and fiber glass frames.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 - 2. Deadbolts: Minimum 1-inch bolt throw.
- C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated on Drawings.
2. Levers: Cast.
 - a. .
3. Escutcheons (Roses): Cast.
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Mortise Locks: ANSI/BHMA A156.13, Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

F. Push-Pull Latches: Bored, ANSI/BHMA A156.2, Series 4000; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.

1. Grade 1.

2.5 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: ANSI/BHMA A156.3.

2.6 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.
- B. Standard Lock Cylinders: ANSI/BHMA A156.5, Grade 1 permanent cores; face finished to match lockset.
 1. Core Type: Interchangeable.
- C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

2.7 KEYING

- A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide one extra key blank for each lock.
 1. No Master Key System: Only change keys operate cylinders.
 - a. Provide three cylinder change keys.
 2. Master Key System: Change keys and a master key operate cylinders.
 - a. Provide three cylinder change keys and five master keys.

3. Keyed Alike: Key all cylinders to same change key.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."

2.8 OPERATING TRIM

- A. Operating Trim: ANSI/BHMA A156.6; stainless steel unless otherwise indicated.

2.9 SURFACE CLOSERS

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

2.10 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.

2.11 DOOR GASKETING

- A. Door Gasketing: ANSI/BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
- B. Maximum Air Leakage: When tested in accordance with ASTM E283/E283M with tested pressure differential of 0.3 inch wg, as follows:
1. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.

2.12 THRESHOLDS

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

2.13 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch-thick aluminum or stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

2.14 AUXILIARY DOOR HARDWARE

- A. Auxiliary Door Hardware: ANSI/BHMA A156.16.

2.15 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended; however, aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2.16 FINISHES

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fiberglass Doors: Comply with door and hardware manufacturers' written instructions

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Fiberglass Doors: "Recommended Locations for Architectural Hardware for Fiberglass Door."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
 - 2. Furnish permanent cores to Owner for installation.
- E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

- F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 1. Do not notch perimeter gasketing to install other surface-applied hardware.
- H. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

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

3.5 ADJUSTING

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

3.6 CLEANING AND PROTECTION

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

3.7 MAINTENANCE SERVICE

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

Navarre Beach Parking and Restroom
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END OF SECTION 08 71 00

SECTION 08 91 19 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed extruded-aluminum louvers.
2. Blank-off panels for louvers

1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing in accordance with AMCA 500-L.
- F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing in accordance with AMCA 540.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.

2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

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

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed in accordance with AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Windborne-debris-impact-resistance test reports.

C. Sample Warranties: For manufacturer's special warranties.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 FIELD CONDITIONS

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

1.7 WARRANTY

A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
- b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Louvers withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures are considered to act normal to the face of the building.
1. Wind Loads:
 - a. Determine loads based on pressures as indicated on Drawings.
- C. Windborne-Debris-Impact Resistance: Louvers located within 30 feet of grade pass basic protection, when tested in accordance with AMCA 540.
- D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width in accordance with AMCA 500-L.

- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- F. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade, Windborne-Debris-Impact-Resistant Louver, Extruded Aluminum:
 - 1. Louver Depth: 4 inches.
 - 2. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
 - 3. Mullion Type: Exposed.
 - 4. Louver Performance Ratings:
 - a. Free Area: Not less than **[8.5 sq. ft.]** for 48-inch-wide by 48-inch-high louver.
 - b. Point of Beginning Water Penetration: Not less than 1077 fpm.
 - c. Air Performance:
 - 1) Not more than 0.16-inch wg static pressure drop at 989-fpm free-area intake velocity.
 - 2) Not more than 0.15-inch wg static pressure drop at 1077-fpm free-area exhaust velocity.
 - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 - 6. AMCA Rating: AMCA 540.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Insect screening.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal: Same type and form of metal as indicated for louver to which screens are attached.
 - 2. Finish: Same finish as louver frames to which louver screens are attached.
 - 3. Type: Rewirable frames with a driven spline or insert.

- D. Louver Screening for Aluminum Louvers:
 - 1. Insect Screening, Aluminum: 18-by-16 mesh, 0.012-inch wire.

2.5 BLANK-OFF PANELS

- A. Uninsulated Blank-Off Panels: Metal sheet attached to back of louver.
 - 1. Aluminum sheet for aluminum louvers, not less than 0.050-inch nominal thickness.
 - 2. Panel Finish: Same finish applied to louvers.
 - 3. Attach blank-off panels with [**sheet metal screws**].

2.6 MATERIALS

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.

2.7 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.
- C. Maintain equal louver blade spacing to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.

- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
 - 2. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.
- G. Provide subsills made of same material as louvers for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.8 ALUMINUM FINISHES

- A. Finish louvers after assembly.
 - B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: As selected by Architect from full range of industry colors and color densities.
- ***** [OR] *****
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 19

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum ceiling board.
2. Abuse-resistant gypsum board.
3. Mold-resistant gypsum board.
4. Glass-mat, water-resistant backing board.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.3 DELIVERY, STORAGE AND HANDLING

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

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A.

2.3 GYPSUM BOARD, GENERAL

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

2.4 INTERIOR GYPSUM BOARD

- A. Gypsum Ceiling Board: ASTM C1396/C1396M.
 - 1. Thickness: 1/2 inch.
 - 2. Long Edges: Tapered.
 - 3. Location: At Unisex and Janitorial Rooms only
- B. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested in accordance with ASTM C1629/C1629M.
 - 1. Core: 5/8 inch, Type X.
 - 2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 - 3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 - 4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 - 5. Long Edges: Tapered.
 - 6. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274. Ensure moisture and mold resistance in addition to abuse resistance.
 - 7. Location: Janitorial Room and Restroom Sink wing walls
- C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch, Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.5 SPECIALTY GYPSUM BOARD

2.6 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.
 - 1. Core: 5/8 inch, Type X.
 - 2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.7 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 - 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.

2.8 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints 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 setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.

4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.9 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."
- C. Vapor Retarder: As specified in Section 07 26 00 "Vapor Retarders."

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- 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. 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: Vertical surfaces unless otherwise indicated.
 - 2. Type X: Vertical surfaces unless otherwise indicated.
 - 3. Ceiling Type: Ceiling surfaces.
 - 4.
 - 5. Abuse-Resistant Type: As indicated on Drawings.
 - 6. Mold-Resistant Type: As indicated on Drawings.
 - 7. Glass-Mat Interior Type: As indicated on Drawings.
 - 8.
- 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 vertically (parallel 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.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- 4.

3.4 INSTALLATION OF TILE BACKING PANELS

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

3.5 INSTALLATION OF 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 in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners.

3.6 FINISHING OF 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 and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Panels that are substrate for tile
 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

- a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

3.7 PROTECTION

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

END OF SECTION 09 29 00

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Tile backing panels.
3. Waterproof membranes.
4. Crack isolation membranes.
5. Setting material.
6. Grout materials.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealing of movement joints in tile surfaces.
2. Section 09 29 00 "Gypsum Board" for tile backing panels.
- 3.
- 4.

1.2 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Large Format Tile: Tile with at least one edge 15 inches or longer.
- D. Module Size: Actual tile size plus joint width indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

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

- B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection or shade variation.
- D. Samples for Verification:
 - 1. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
 - 2. Full-size units of each type of trim and accessory for each color and finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product, including product use classification.
- D. Product Test Reports:
 - 1. Tile-setting and -grouting products.
 - 2. Certified porcelain tile.
 - 3. Slip-resistance test reports from qualified independent testing agency.
- E. Field Quality-Control Reports: Water test reports of membrane in wet areas.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's supervisor for Project holds the International Masonry Institute's Supervisor Certification.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

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

1.10 WARRANTY

- A. System Warranty: Manufacturer's non-prorated comprehensive warranty that agrees to repair and replace defective installation areas, material, and labor that fail under normal usage within specified warranty period.
 - 1. Warranty Period: Five years from date of Product Purchase.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Tiling System: Obtain system products from single manufacturer and each aggregate from single source or producer.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. MAPEI Corporation.
 - b. Coastal Tile

2. Obtain setting and grouting materials, except for unmodified portland cement and aggregate, from single manufacturer.
 3. Obtain underlayment from manufacturer of setting and grouting materials.
 4. Obtain waterproof membrane, crack isolation, and other required membranes from manufacturer of setting and grouting materials.
 5. Obtain joint sealants from manufacturer of setting and grouting materials.
- C. Accessory Products: Obtain each of the following products specified in this Section from a single manufacturer:
1. Stone thresholds.
 2. Backer units.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
1. Provide tile complying with Standard Grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 PORCELAIN TILE

- A. Porcelain Tile Type: Glazed.

1. Manufacturers: Subject to compliance with requirements, provide products by the following
 - a. PT-1: Coastal Tile – Cocoon Bliss
 - b. PT-2: Coastal Tile – Sprint Ivory
 - c. PT-3: Coastal Tile – Vision Color Forest and Jade Green Mosaic
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size:
 - a. PT-1: 8 by 48 inches (20 x 120 cm)
 - b. PT-2: 12 by 24 inches
 - c. PT-3: 12 by 24 inch mesh
4. Face Size Variation: Rectified.
5. Product Use Classification: Interior, Wet (IW)
6. Grout Color: As selected by Architect from manufacturer's full range
 - a. Base Cap: Surface bullnose, module size same as adjoining flat tile
 - b. Wainscot Cap: Surface bullnose, module size same as adjoining flat tile
 - c. External Corners: Surface bullnose, module size same as adjoining flat tile
 - d. Internal Corners: Field-buttet square corners.

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Solid-Surface Thresholds: Homogeneous-filled plastic resin complying with ISFA-02-01.
 1. Description:
 - a. Type: Provide Standard type.
 - b. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.5 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Gypsum Panel: ASTM C1658/C1658M, with fiberglass mat partially or completely embedded into the core.
 1. Core: 5/8 inch, Type X

2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.6 WATERPROOF MEMBRANES

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and ANSI A118.12 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Waterproof Membrane, Sheet: Polyethylene sheet faced on one or both sides with polyester fabric.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Schluter Systems L.P.
 2. Nominal Thickness: 0.03 inch

2.7 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Crack Isolation Membrane, Polyethylene Sheet: Polyethylene faced on both sides with polyester fabric.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Schluter Systems L.P.

2.8 SETTING MATERIALS

- A. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
 1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.1.
- B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.4.

2.9 GROUT MATERIALS

- A. Standard Cement Grout: ANSI A118.6.

2.10 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.
- C. Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Schluter Systems L.P.
 - 2. Description: Reno-Ramp/-K
 - 3. Material and Finish: Satin Anodized Aluminum
 - a. Color: gray
- D. Metal Cove Base
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Schluter Systems L.P.
 - 2. Description: Dilex-HKS Cove Base
 - 3. Material and Finish: stainless steel
 - Color: gray
- E. Metal Edge Trim: Profile designed for wall terminations and edge protection.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Schluter Systems L.P.
 - 2. Description: Dilex-HKW or similar
 - 3. Terminations: Inside corners matching edge-protection profile.
 - 4. Material and Finish: per architectural drawings
 - a. Color: per architectural drawings
- F. Metal Edge Trim: Profile designed for wall terminations and edge protection.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Schluter Systems L.P.
 2. Description: Quadec Corner Trim
 3. Terminations: [**Outside corners**] matching edge-protection profile.
 4. Material and Finish: per architectural drawings
 - a. Color: per architectural drawings
- G. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.
- H. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- I. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.

- B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- E. Substrate Flatness:
 - 1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
 - 2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

- A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.
- B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.
- C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
 - 1. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- D. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
 - 1. Add materials, water, and additives in accurate proportions.

2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.
- E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.
1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile walls in wet areas
 2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 4. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
 5. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in finished Work.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
 6. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- F. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt,

debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- G. Thresholds: Install stone and solid surface thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 1. Do not extend cleavage membrane waterproof membrane or crack isolation membrane under thresholds set in standard dry-set mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane waterproof membrane or crack isolation membrane with elastomeric sealant.
- H. Metal Wall Trim: Install at locations indicated on Drawings.
- I. Grout Sealer: Apply grout sealer to grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 FIELD QUALITY CONTROL

A. Water Test:

1. Test of waterproofing membrane in showers and similar areas to be performed by Installation Contractor before setting tile.
 - a. Perform test after 24 hours of waterproof membrane installation.
 - b. Insert test plug in drain or waste line.
 - c. Fill shower base with water, high enough that the membrane-to-drain connection and floor-to-wall transition can be evaluated, and mark wall.
 - d. Check for leaks after 24 hours.
2. Test to be witnessed by authorities having jurisdiction

B. Nonconforming Work:

1. Waterproof membrane will be considered defective if water level has dropped.
2. Remove and replace defective components and retest.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Wood Subfloor:
 1. TCNA F142: Organic adhesive on plywood underlayment.
 - a. Ceramic Tile Type: .
 - b. Grout: Sand-portland cement grout.
 - c. Joint Width: 1/4 inch.
 - d. Movement Joints: Types located on Drawings.
- B. Interior Wall Installations, Wood or Metal Studs or Furring:
 1. TCNA W242: Organic adhesive on gypsum board.
 - a. Ceramic Tile Type: PT-2 and PT-3
 - b. Grout: Sand-portland cement grout.
 - c. Joint Width: 1/4 inch
 - d. Movement Joints: Types located on Drawings.

END OF SECTION 09 30 13

SECTION 09 91 14 - EXTERIOR PAINTING (MPI STANDARDS)

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. Surface preparation and application of paint systems on the following exterior substrates:
 - a. Fiber-cement board.
 - b. Wood.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include preparation requirements and application instructions.
 - 2. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 3. Indicate VOC content.

- B. Samples: For each type of topcoat product.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - 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 mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 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.

1.7 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 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product listed in the Exterior Painting Schedule for the paint category indicated.
- B. Source Limitations: Obtain paint from single source from single manufacturer.

2.2 PAINT PRODUCTS

- A. MPI Standards: Provide products complying with MPI standards indicated and 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 topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Owner from manufacturer's full range.

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 the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Fiber-Cement Board: 12 percent.
 - 2. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. 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 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 impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and remove sanding dust.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Manual."
 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.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. 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 instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

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

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 3. Allow empty paint cans to dry before disposal.
 4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Cement Board Substrates:

1. Latex System MPI EXT 3.3A:
 - a. Latex Prime Coat: Exterior, matching topcoat.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Low-Sheen Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
 - 1) .

***** [OR] *****

2. Water-Based Light Industrial Coating System MPI EXT 3.3C:
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - 1) .
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Low-Sheen Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.
 - 1) .

B. Wood Substrates: Exposed framing.

1. Latex over Latex Primer System MPI EXT 6.2M:

- a. Prime Coat: Primer, latex for exterior wood, MPI #6.
1) .
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Low-Sheen Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
1) .

C. Fiberglass Substrates:

1. Latex System MPI EXT 6.7A:

- a. Prime Coat: Primer, bonding, solvent based, MPI #69.
1) .
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Semigloss Topcoat: Latex, exterior, semigloss (MPI Gloss Level 5), MPI #11.
1) .

END OF SECTION 09 91 14

SECTION 09 91 24 - INTERIOR PAINTING (MPI STANDARDS)

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 surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
 - 1. Section 05 52 13 "Pipe and Tube Railings" for shop priming pipe and tube railings.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 2. Indicate VOC content.
- 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. Apply coats on Samples in steps 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: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

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 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 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 of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."
- B. 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 coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Owner from manufacturer's full range.

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 the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Fiber-Cement Board: 12 percent.
 - 2. Wood: 15 percent.
 - 3. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- 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 impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 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.

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. Wood Substrates: Exposed framing.
 - 1. Latex over Latex Primer System, MPI INT 6.2D:
 - a. Prime Coat: Primer, latex, for interior wood, MPI #39.
 - 1) .
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.

1) .

B. Wood Substrates: Wood trim Architectural woodwork.

1. Latex over Latex Primer System, MPI INT 6.3T:

- a. Prime Coat: Primer, latex, for interior wood, MPI #39.

1) .

- b. Intermediate Coat: Latex, interior, matching topcoat.

- c. Topcoat: Latex, interior (MPI Gloss Level 2), MPI #44.

1) .

C. Gypsum Board Substrates:

1. Latex over Latex Sealer System[, MPI INT 9.2A]:

- a. Prime Coat: Primer sealer, latex, interior[, MPI #50].

1) <Insert manufacturer's name; product name or designation>.

- b. Prime Coat: Latex, interior, matching topcoat.

- c. Intermediate Coat: Latex, interior, matching topcoat.

- d. Topcoat: Latex, interior, flat (MPI Gloss Level 1)[, MPI #53].

1) <Insert manufacturer's name; product name or designation>.

- e. Topcoat: Latex, interior (MPI Gloss Level 2)[, MPI #44].

1) <Insert manufacturer's name; product name or designation>.

- f. Topcoat: Latex, interior (MPI Gloss Level 3)[, MPI #52].

1) <Insert manufacturer's name; product name or designation>.

- g. Topcoat: Latex, interior (MPI Gloss Level 4)[, MPI #43].

1) <Insert manufacturer's name; product name or designation>.

- h. Topcoat: Latex, interior, semigloss (MPI Gloss Level 5)[, MPI #54].

1) <Insert manufacturer's name; product name or designation>.

- i. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees)[, MPI #114].

- 1) <Insert manufacturer's name; product name or designation>.
2. Latex over Alkyd Primer System (for Plaster Only)[, **MPI INT 9.2K**]:
 - a. Prime Coat: Primer sealer, alkyd, interior[, **MPI #45**].
 - 1) <Insert manufacturer's name; product name or designation>.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1)[, **MPI #53**].
 - 1) <Insert manufacturer's name; product name or designation>.
 - d. Topcoat: Latex, interior (MPI Gloss Level 2)[, **MPI #44**].
 - 1) <Insert manufacturer's name; product name or designation>.
 - e. Topcoat: Latex, interior (MPI Gloss Level 3)[, **MPI #52**].
 - 1) <Insert manufacturer's name; product name or designation>.
 - f. Topcoat: Latex, interior (MPI Gloss Level 4)[, **MPI #43**].
 - 1) <Insert manufacturer's name; product name or designation>.
 - g. Topcoat: Latex, interior, semigloss (MPI Gloss Level 5)[, **MPI #54**].
 - 1) <Insert manufacturer's name; product name or designation>.
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees)[, **MPI #114**].
 - 1) <Insert manufacturer's name; product name or designation>.
3. Institutional Low-Odor/VOC Latex System[, **MPI INT 9.2M**]:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC[, **MPI #149**].
 - 1) <Insert manufacturer's name; product name or designation>.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1)[, **MPI #143**].
 - 1) <Insert manufacturer's name; product name or designation>.

- d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2)[, **MPI #144**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
- e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3)[, **MPI #145**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
- f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4)[, **MPI #146**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
- g. Topcoat: Latex, interior, institutional low odor/VOC, semigloss (MPI Gloss Level 5)[, **MPI #147**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
- h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6)[, **MPI #148**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
- 4. High-Performance Architectural Latex System[, **MPI INT 9.2B**]:
 - a. Prime Coat: Primer sealer, latex, interior[, **MPI #50**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2)[, **MPI #138**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3)[, **MPI #139**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4)[, **MPI #140**].
 - 1) **<Insert manufacturer's name; product name or designation>.**

- f. Topcoat: Latex, interior, high performance architectural, semigloss (MPI Gloss Level 5)[, **MPI #141**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
- 5. Water-Based Light-Industrial Coating System[, **MPI INT 9.2L**]:
 - a. Prime Coat: Primer sealer, latex, interior[, **MPI #50**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
 - b. Intermediate Coat: Light-industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light-industrial coating, interior, water based (MPI Gloss Level 3)[, **MPI #151**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
 - d. Topcoat: Light-industrial coating, interior, water based, semigloss (MPI Gloss Level 5)[, **MPI #153**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
 - e. Topcoat: Light-industrial coating, interior, water based, gloss (MPI Gloss Level 6)[, **MPI #154**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
- 6. Alkyd over Latex Sealer System[, **MPI INT 9.2C**]:
 - a. Prime Coat: Primer sealer, latex, interior[, **MPI #50**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1)[, **MPI #49**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3)[, **MPI #51**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
 - e. Topcoat: Alkyd, interior, semigloss (MPI Gloss Level 5)[, **MPI #47**].
 - 1) **<Insert manufacturer's name; product name or designation>.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6)[, **MPI #48**].

- 1) <Insert manufacturer's name; product name or designation>.

END OF SECTION 09 91 24

SECTION 10 21 13.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for blocking.
2. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

- A. Coordinate requirements for blocking, reinforcing, and other supports concealed within wall and ceiling to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data.

1. Phenolic-core toilet compartments.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.

1. Include Samples of hardware and accessories involving material and color selection.

- D. Samples for Verification: Actual sample of finished products for each type of toilet compartment, hardware, and accessory.
 - 1. Size: Manufacturers' standard size.
- E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.
- F. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For toilet compartments.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Materials: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Door Hinges: One hinge(s) with associated fasteners.
 - 2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
 - 3. Door Bumper: One door bumper(s) with associated fasteners.
 - 4. Door Pull: One door pull(s) with associated fasteners.
 - 5. Fasteners: 10 fasteners of each size and type.

1.6 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain phenolic-core toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:
 - 1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.
- C. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" for toilet compartments designated as accessible.

2.3 PHENOLIC-CORE TOILET COMPARTMENTS

- A. Toilet-Enclosure Style: Floor anchored, privacy type.
- B. Urinal-Screen Style: Wall hung.
- C. Door, Panel, and Pilaster Construction: Solid phenolic-core material with melamine facing on both sides fused to substrate during manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch-thick doors and pilasters and minimum 1/2-inch-thick panels.
- D. Urinal-Screen Construction: Matching panel construction.
- E. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- F. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- G. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, stainless steel.
- H. Phenolic Compartment Finish: One color in each room.
 - 1. Through-Color Phenolic: Manufacturer's standard solid through-color.
 - a. Color: As selected by Owner from manufacturer's full range.

2.4 HARDWARE AND ACCESSORIES

- A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories. Mount with through bolts.
 - 1. Hinges: Manufacturer's standard, allowing emergency access by lifting door.
 - 2. Latch and Keeper: Manufacturer's standard stainless steel, surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.
 - 3. Coat Hook: Manufacturer's standard stainless steel combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.
 - 4. Door Bumper: Manufacturer's standard stainless steel, rubber-tipped bumper at outswinging doors.
 - 5. Door Pull: Manufacturer's standard stainless steel pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.5 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: ASTM B221.
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless Steel Castings: ASTM A743/A743M.

2.6 FABRICATION

- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, inswinging doors for standard toilet enclosures and 36-inch-wide, outswinging doors with a minimum 32-inch-wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels or Screens: 1/2 inch.
 - b. Panels or Screens and Walls: 1 inch.
 - 2. Stirrup Brackets: Secure panels or screens to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.17

SECTION 102600 - WALL AND DOOR PROTECTION

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. Corner guards.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for kick plates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
 - 1. Include plans, elevations, sections, and attachment details.
- C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
 - 1. Corner Guards: 12 inches long. Include example top caps.
 - 2. Inside corner expansion joints: 12 inches long. Include example top caps

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of handrail.
- B. Material Certificates: For each type of exposed plastic material.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
 - 1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

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. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch- long units.
 - 2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store wall protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Keep plastic materials out of direct sunlight.
 - 3. Store plastic wall -protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Outside Corners: Schluter Quadec Corner Trim – Stainless Steel
- B. Inside Corners (expansion joints): Schluter Dilex-HKW or similar – Stainless Steel
- C. Source Limitations: Obtain wall-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- degree turn to match wall condition.
 - 1. Material: Stainless-steel sheet, Type 304.
 - a. Thickness: Minimum 16 gauge.
 - b. Finish: Directional satin, No. 4.
 - 2. Wing Size: per tile thickness
 - 3. Corner Radius: per manufacturer's standard
 - 4. Mounting: per manufacturer's standard
 - 5. Height: **8'-2-1/2" (2.5 m)**

2.4 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.5 FABRICATION

- A. Fabricate wall protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
 - 2. Adjust top caps as required to ensure tight seams.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

END OF SECTION 102600

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
- 2.
3. Childcare accessories.
4. Underlavatory guards.
5. Custodial accessories.
6. Hand-sanitizer dispensers.

B. Related Requirements:

- 1.
2. Section 09 30 13 "Ceramic Tiling" for ceramic toilet and bath accessories.

1.2 COORDINATION

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

1.3 ACTION SUBMITTALS

A. Product Data:

1. Public-use washroom accessories.
2. Childcare accessories.
3. Underlavatory guards.
4. Custodial accessories.
5. Hand-sanitizer dispensers.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 1. Identify locations using room designations indicated.
 2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

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

1.5 CLOSEOUT SUBMITTALS

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

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, visible silver spoilage defects.
 2. Warranty Period: 10 years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser TTD:
 1. ; BW 80300 (per drawings) Description: Double-roll dispenser with shelf.

2. Mounting: Surface mounted.
3. Operation: Eccentric-shaped, molded-plastic spindle revolves one-half revolution per dispensing operation for controlled delivery; core cannot be removed until roll is empty.
4. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)

C. Paper Towel (Folded) Dispenser PTD:

1. [Bobrick; B-262 \(per drawings\)](#)
2. Mounting: Surface mounted.
3. Minimum Capacity: 600 C-fold or 800 multifold towels
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)
5. Lockset: Tumbler type.
6. Refill Indicator: Pierced slots at sides or front.

D. Soap Dispenser <Insert drawing designation>:

1. [Betco Clario; 91821](#)
2. Description: Designed for manual operation and dispensing soap in liquidform.
3. Mounting: Vertically oriented, surface mounted
4. Capacity: 27 oz.
5. Materials: **Stainless steel, ASTM A480/A480M No. 4 finish (satin).**
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

E. Grab Bar GB-1, GB-2

1. [Bobrick; B-6806 \(per drawings\)](#)
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. OD: 1-1/2 inches.
5. Configuration and Length: [**As indicated on Drawings**]

F. Sanitary-Napkin Disposal Unit SND:

- 1.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)

G. Mirror UnitMIR:

1. [Bobrick; B-290 2448 \(per drawings\)](#)
2. Frame: Stainless steel channel
 - a. Corners: Welded and ground smooth.
3. Size: As indicated on Drawings

H. Coat Hook CH:

1. [Bobrick; B-6717 \(per drawings\)](#)
2. Description: Combination hat and coat hook
3. Mounting: Concealed
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)

2.3 CHILDCARE ACCESSORIES

A. Baby-Changing Station BCS:

1. [Bobrick; KB310-SSWM](#)
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of 250 lb static load when opened.
3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners
6. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

2.4 UNDERLAVATORY GUARDS

A. Underlavatory Guard (provide at all lavatories)

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

2.5 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Custodial Mop and Broom Holder: BH

1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.

2. Length: 36 inches.
3. Hooks: Four.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.
 - b. Rod: Approximately 1/4-inch-diameter stainless steel.

2.6 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch-minimum nominal thickness unless otherwise indicated.
- B. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.
- C. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- E. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.7 FABRICATION

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

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with 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.
 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 10 28 00

SECTION 22 00 00 - PLUMBING GENERAL

PART 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. The work shall include but shall not be limited to the following:
Provide all plumbing and associated fittings, valves, and accessories for the project. Fully coordinate all plumbing requirements with work by other divisions under this construction contract. All systems shall be complete and fully functional.
- 1.2 Related Documents:
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
 - B. Provisions of this section apply to work of all Division 22 sections.
 - C. Review all other contract documents to be aware of conditions affecting work herein.
- 1.3 Definitions:
 - A. Provide: Furnish and install, complete and ready for intended use.
 - B. Furnish: Supply and deliver to the project site, ready for subsequent requirements.
 - C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- 1.4 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for Division 22 work and pay all fees and charges incidental thereto.
- 1.5 Verification of Owner's Survey Data: Prior to commencing any work, the Contractor shall verify the accuracy of all survey 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, such items shall immediately be notified to the Architect/Engineer so that proper adjustments can be anticipated and ordered. Commencement by the Contractor of work shall be held as an acceptance of the data after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions or inaccuracies of the said data.
- 1.6 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.
- 1.7 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be construed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.
- 1.8 Field Measurements and Coordination:
 - A. 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. Report conflicts prior to start of work.
 - B. Verify all field dimensions and locations of equipment to ensure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.
 - C. Coordinate work in this division with all other trades in proper sequence to ensure that the total work is completed within contract time schedule and with minimum cutting and patching.
 - D. Locate all equipment, piping, and 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. Provide all required work clearances as defined by code and manufacturer's recommendations.

- E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.
 - F. 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 by the Engineer to resolve discrepancies.
 - G. 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, 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 verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or material cannot be fitted, the 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.
- 1.9 Guarantee and Service:
- A. The Contractor shall guarantee labor, materials and equipment for a period of one (1) year from Substantial 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. Manufacturer warranties do not relieve the Contractor of this responsibility.
 - B. Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond or relieving Contractor of his responsibilities during guarantee period.
 - C. Contractor shall provide service of all new equipment during the guarantee period without additional expense to the Owner.
- 1.10 Approval Submittals:
- A. Shop drawings, product literature, and other approved 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. Submittals shall include all applicable items referenced in each specification section, and not include items from more than one specification section in the same submittal.
 - 2. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control numbers, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approved stamps. A sample cover sheet is included at the end of this section.
 - 3. 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.
 - 4. Submittals shall be combined into a single submittal package with a table of contents. Submittals shall not be issued as multiple individual submittal packages.
 - 5. 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.

- B. Before ordering any materials or equipment, and within 30 days after the award of the contract, the Contractor shall submit to the Architect/Engineer one complete schedule showing the make, type, manufacturer's name and trade designation of all equipment.
 - 1. This schedule shall be accompanied by the required number of copies of the manufacturer's printed specifications and shop drawings for each piece of equipment or specialty and shall give dimensions, diagrams, descriptive literature, capacity or rating, kind of material, finish, guarantee, etc., and such other detailed information as the Architect/Engineer may require.
 - 2. When approved, such schedule shall be an addition to these specifications, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.
- C. If the shop drawings show variation from the requirements of the contract documents, the Contractor shall make specific mention of such variation in his letter of transmittal. If acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.
- D. Review of shop drawings, descriptive 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 such deviation at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, descriptive 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.
- E. Submit shop drawings and any other drawings called for in other sections. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than 1/4" 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.
- F. Submit product data after award of the contract and before any equipment or materials are purchased. Product data are defined as manufacturer's printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. Properly coded stamp from the Engineer on returned submittal is required before ordering equipment.
- G. Coordinate with other divisions supplying equipment prior to submitting shop drawings.
- H. Shop drawings shall be submitted in one package unless approved otherwise by the Engineer. Provide an index of sections listing manufacturers and "as-specified" or not. Each specification section shall be tabbed with equipment inserted.
- 1.11 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, review the reports, and take corrective action within the scheduled contract time.
- 1.12 O&M Data Submittals: Submit Operations and Maintenance data as called for in other sections when a copy of approved submittals is included in the O&M Manual, only the final "Furnish as Submitted" or "Furnish as Corrected" copy shall be used. Contractor shall organize these later 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.

PART 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. 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:

- A. Any material or equipment used in any potable water system intended for human consumption, including inline devices (i.e. valves, fittings, pumps, meters) and end point devices (ie. drinking water fountains, faucets, ice makers, supply stops, control valves for dispensing), shall be certified "lead-free" in accordance with NSF/ANSI 61.
- B. Equipment and materials 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 equipment or materials.
- C. Each item of equipment shall bear a nameplate 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.
- D. The label of the approving agency, such as UL, ASME, or FM, by which a standard has been established for each particular item, shall be in full view.
- E. 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.
- F. A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.
- G. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.
- H. 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 meet detailed specifications and that size and arrangement of the equipment are suitable for installation.
- I. 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 equipment and materials in accordance with the written description of each item and with the intent of the drawings and specifications.
- J. All equipment and material shall be manufactured and assembled in the United States.

2.3 Requests for Substitution:

- A. 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. Other systems, products, equipment or materials may be accepted only if in the opinion of the Engineer, that they are equivalent in quality and workmanship and will perform satisfactorily its intended purpose. The Engineer shall approve all such substitutions in materials or equipment in writing. This shall occur prior to bidding.
- B. In making requests for substitutions, the Contractor shall list the particular system, product, equipment or material he wishes to substitute and, at bid time, the Contractor shall state the amount he will add or deduct from his base bid if the substitution is approved by the Engineer. If the Contractor allows no deduction or addition to the base bid for such substitution, it shall be stated on the request.
- C. Requests by the Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

1. Required product cannot be supplied in time for compliance with Contract time requirements.
 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 disabilities as certified by the Contractor.
 3. Substantial cost advantage is offered to the Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.
- D. All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences and omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include, but not limited to, data as follows for both the specified and substituted products:
1. Principle of operation.
 2. Materials of construction or finishes.
 3. Thickness or gauge of materials.
 4. Weight of item.
 5. Deleted features or items.
 6. Added features or items.
 7. Changes in other work caused by the substitution.
 8. Performance and rating data.
- E. If the approved substitution contains differences or omissions not specifically called to the attention of the Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products at the Contractor's expense.
- 2.4 Prior Approval: Prior Approval shall be required for any manufacturer other than those listed for all specified items in the drawings and specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the drawings and specifications. Clearly indicate all differences between the specified and proposed product following the guidelines for substitution herein. This requirement may be waived if, in the opinion of the Engineer, it is in the best interest of the Owner. Submittals received after award of the bid for equipment that has not be Prior Approved shall be subject to immediate rejection.

PART 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:
- A. 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 or other equipment passing through slabs or walls.
 - B. Any additional steel supports required for the installation of any plumbing equipment or piping shall be furnished and installed under the section of the specifications requiring the additional supports.
 - C. It shall be the Contractor's responsibility to verify all equipment such as valves 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.
 - D. 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.

- E. The Contractor shall protect equipment, material, and fixtures at all times during storage and construction. The Contractor shall replace all equipment, material, and fixtures which are damaged as a result of inadequate protection.
 - F. 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.
 - G. 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 disconnection 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, 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: Contractor shall be responsible for cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under these Specifications. 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. If corrosion is found to be extensive by the Engineer, the equipment shall be removed and replaced with factory new at the expense of the Contractor.
- 3.8 Cleanup: 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 Startup and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, startup shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in startup check.
- 3.10 Record Drawings:
- A. During the progress of the work, the Contractor shall record on his field set of drawings the exact location, as installed, of all piping, equipment, and other systems which are not installed exactly as shown on the contract drawings.
 - B. 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:
- A. Request inspections as required under the Supplementary or General Conditions. Conceal no work until inspected.
 - B. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed. The Contractor shall pay, at the Engineer's current billing rate, for additional field time required by the Engineer to report or check on previous punch list deficiencies.
 - C. Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.

- D. Operation and Maintenance Manuals: Furnish complete manuals electronically and organized by system or section. Manuals shall contain:
 - 1. Detailed operating instructions and instructions for making minor adjustments.
 - 2. Routine maintenance operations.
 - 3. Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
 - 4. Copies of approved submittals.
 - 5. Copies of all manufacturers' warranties.
 - 6. Copies of test reports and verification submittals.
- E. Warranties: Submit copies of all manufacturers' warranties.
- F. Record Drawings: Submit record drawings.

**This is a sample cover
sheet. Use one for
each shop drawing.**

ARCHITECT/ENGINEER: W3 Engineering Inc.
CONTRACTOR: XYZ Construction
SUBCONTRACTOR: ABC Plumbing Contractor
SUPPLIER: Supply Company
MANUFACTURER: Manufacturer
DATE: MM/DD/YYYY
SECTION: 22 XX XX / Section Name

PROJECT NAME
PROJECT NUMBER

Any standard
heading is
acceptable

SAMPLE

1. Description: Manufacturer, Model
2. Description: Manufacturer, Model
3. Description: Manufacturer, Model
4. Description: Manufacturer, Model
5. Description: Manufacturer, Model

**List each item
separately;
include
manufacturer name
and model number.**

END OF SECTION

**Contractor's
APPROVAL stamp
must be on this
sheet.**

SECTION 22 00 10 - CODES AND STANDARDS

PART 1 - GENERAL

- 1.1 All work under Division 22 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, the Contractor shall be responsible for calling to the Architect/Engineer's attention any details on the drawings or specifications that are not in conformance with these or other codes and standards.
- 1.2 Comply with regulations and codes of utility suppliers.
- 1.3 Where no specific method or form of construction is called for in the contract documents, the Contractor shall comply with code requirements when carrying out such work.
- 1.4 Where code conflict exists, the most stringent requirement applies. Comply with current code edition, unless noted.

PART 2 - CODES

- 2.1 The following codes shall govern all work:
 1. Florida Building Code – Eighth Edition (2023) – Building
 2. Florida Building Code – Eighth Edition (2023) – Existing Building
 3. Florida Building Code – Eighth Edition (2023) – Energy Conservation
 4. Florida Building Code – Eighth Edition (2023) – Mechanical
 5. Florida Building Code – Eighth Edition (2023) – Plumbing
 6. Florida Building Code – Eighth Edition (2023) – Fuel Gas
 7. Florida Building Code – Eighth Edition (2023) – Accessibility
 8. National Electric Code (NFPA 70) – 2014
 9. Fire Alarm and Signaling Code (NFPA 72) – 2013
 10. Standard for Air Conditioning and Ventilating Systems (NFPA 90A) – 2015
 11. Standard for Commercial Cooking Operations (NFPA 96) – 2014
 12. Health Care Facilities Code (NFPA 99) – 2021
 13. FGI Guidelines for Design and Construction of Hospitals and Outpatient Facilities – 2022
 14. Florida Fire Prevention Code Fifth Edition
 - a. Fire Code (NFPA 1) – 2021
 - b. Life Safety Code (NFPA 101) – 2021

PART 3 - STANDARDS

- 3.1 All plumbing materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments, to the extent referenced:
 1. Underwriters' Laboratories (UL)
 2. Factory Mutual Global (FM)
 3. American National Standards Institute (ANSI)
 4. American Society of Testing Materials (ASTM)
 5. National Fire Protection Association (NFPA)

END OF SECTION

SECTION 22 00 20 - PLUMBING RELATED WORK

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.
- B. This is a Common Work Results for Plumbing section. The provisions of this section apply to work of all Division 22 sections.
- C. Coordinate with the General Contractor for all cutting and patching. Contractors performing Division 22 work shall inform the General Contractor of all cutting and patching required prior to bidding and shall coordinate installation.

PART 2 - DIVISION 2 – SITE WORK

2.1 Specific requirements for excavation and backfill for underground piping are contained in Section 22 05 50.

2.2 Refer to Division 2 – Site Work for:

- A. All water, sewer, and storm water piping greater than five feet from the building.
- B. Manholes and catch-basins.
- C. Underground tanks and enclosures.
- D. Septic tanks and drainfields.

2.3 The following work is part of Division 22:

- A. All site piping within five feet of building footprint.
- B. Underground tanks and enclosures within five feet of building footprint.
- C. Grease trap.

PART 3 - DIVISION 3 – CONCRETE

3.1 Refer to Division 3 – Concrete for:

- A. Rough grouting in and around plumbing work.
- B. Cutting and patching concrete to accommodate plumbing work.

3.2 The following work is part of Division 22, complying with the requirements of Division 3:

- A. Curbs, foundations and pads for plumbing equipment.
- B. Basins, sumps, and vaults for plumbing work.
- C. Underground structural concrete to accommodate plumbing work.
- D. Inertia bases.

PART 4 - DIVISION 4 – MASONRY

4.1 Refer to Division 4 – Masonry for:

- A. Installation of access doors in walls.

PART 5 - DIVISION 5 – METALS

5.1 Refer to Division 5 – Metals for:

- A. Framing openings for plumbing equipment.

5.2 The following work is part of Division 22:

- A. Support for plumbing work.

PART 6 - DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

6.1 Refer to Division 6 – Wood, Plastics, and Composites for:

- A. Framing openings for plumbing equipment.

PART 7 - DIVISION 7 – THERMAL AND MOISTURE PROTECTION

7.1 Refer to Division 7 – Thermal and Moisture Protection for:

- A. Installation of all roof curbs and roof support for plumbing work.
- B. Caulking and waterproofing of all wall- and roof-mounted plumbing work.
- C. Flashing of all roof curbs and roof vents.

7.2 The following work is part of Division 22, complying with the requirements of Division 7:

- A. Fire barrier penetration seals.

PART 8 - DIVISION 9 – FINISHES

8.1 Refer to Division 9 – Finishes for:

- A. Painting exposed piping and equipment.

- B. Painting structural metal and concrete for plumbing work.
 - C. Painting access panels.
 - D. Painting color-coded plumbing work indicated for continuous painting. See color schedule in Division 22 Section, "Plumbing Identification".
 - E. Installation of access doors in gypsum drywall.
- 8.2 Colors shall be selected by the Architect for all paintings of exposed plumbing work in occupied spaces, unless specified herein. Do not paint insulated or jacketed surfaces.
- 8.3 The following work is part of Division 22:
- A. Touch-up painting of factory finishes.
 - B. Painting of all hangers.

PART 9 - DIVISION 11 – EQUIPMENT

- 9.1 The following work is part of Division 22:
- A. All trim including faucets, waste connections, drain traps, vents, valves, piping, flashing, fittings, strainers, and other materials necessary to make equipment operational. Provide rough-in for all equipment. Provide final connections for all equipment.
 - B. All automatic gas valves for shutoff to cooking appliances when fire suppression system

END OF SECTION

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. This section is a Division 22 Common Work Results for Plumbing section and is part of each Division 22 section making reference to or requiring sleeves and sleeve seals specified herein.

1.2 Approval Submittals:

- A. Product Data: Submit product data with installation instructions and UL listing for:
 - 1. Fire barrier sealants.

PART 2 - PRODUCTS

- 2.1 General: Provide factory-fabricated sleeves and sleeve seals recommended by manufacturer for use in service indicated. Provide sleeves and sleeve seals of type 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:

- A. 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 the outside diameter of escutcheon to completely cover pipe penetration holes 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.
- B. 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.
- C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.3 Fire Barrier Penetration Seals:

- A. Provide seals for any opening through fire-rated walls, floors, or ceilings used as passage for plumbing components such as piping in accordance with the requirements of Division 7.
- B. Cracks, Voids, or Holes Up to 4" Diameter: Use putty or calking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.
- C. Openings 4" or Greater: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350°F, UL-listed.

2.4 Fabricated Piping Specialties:

- A. 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.
- B. Pipe Sleeves: Provide pipe sleeves of one of the following:
 - 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 gauges: 3" and smaller, 20 gauge; 4" to 6" 16 gauge; over 6", 14 gauge.
 - 2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
 - 3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

- C. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:

1. Caulking and Sealant: Provide foam or caulking and sealant compatible with piping materials used.

PART 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 Fire Barrier Penetration Seals: Provide pipe sleeve as required. Fill the entire opening with sealing compound. Adhere to manufacturer's installation instructions.
- 3.3 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.
- 3.4 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 2" above finished floor. 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.
- A. Install sleeves in fire-rated assemblies in accordance with the listing of the assembly and the fire barrier sealant.
- B. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings. Fill annular space with caulking or fire barrier sealant as required.
- C. Install steel-pipe sleeves at floor penetrations. Fill annular space with caulking or fire barrier sealant as required.
- D. 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.

END OF SECTION

SECTION 22 05 23 - VALVES

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. This section is a Division 22 Common Work Results for Plumbing section and is part of each Division 22 section making reference to or requiring valves specified herein.
- C. Extent of valves required by this section is indicated on drawings and/or specified in other Division 22 sections.

1.2 Codes and Standards:

- A. UL Compliance: Comply with applicable UL standards pertaining to valves.
- B. Any material or equipment used in any potable water system intended for human consumption shall be certified "lead-free" in accordance with NSF/ANSI 61.

1.3 Quality Assurance:

- A. Valve Types: Provide valves of same type by same manufacturer.

1.4 Approval Submittals: When required by other Division 22 sections, 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 22 section using the valves, not as a separate submittal. For each valve, identify systems where the valve is intended for use.

- A. Gate Valves: Type GA.
- B. Globe Valves: Type GL.
- C. Check Valves: Type CK.
- D. Ball Valves: Type BA.

1.5 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 in O&M Manual.

PART 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:

- A. 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.
- B. Comply with the following standards:

- 1. Cast Iron Valves: MSS SP-70. Cast Iron Gate Valves, Flanged and Threaded Ends.
- 2. Bronze Valves: MSS SP-80. Bronze Gate, Angle and Check Valves.
- 3. Steel Valves: ANSI B16.34. Steel Standard Class Valve Ratings.

- C. Types of Gate (GA) Valves:

- 1. Threaded Ends 2" and Smaller (GA1): Class 125, bronze body, screwed bonnet, rising stem, solid wedge. Apollo Valves, a division of Aalberts-IPS 101T. Stockham B-100. Nibco T-111. Crane 428. Milwaukee 148.

2. Soldered Ends 2" and Smaller (GA2): Class 125, bronze body, screwed bonnet, rising stem, solid wedge. Apollo Valves, a division of Aalberts-IPS 101S. Stockham B-108 or B-109. Nibco S-111. Crane 1334. Milwaukee 149.
 3. Flanged Ends 2-1/2" and Larger (GA3): Class 125, iron body, bronze mounted, bolted bonnet, rising stem, OS&Y, solid wedge. Apollo Valves, a division of Aalberts-IPS 611F. Stockham G-623. Nibco F617-0. Crane 465-1/2. Milwaukee F2885.
 4. Threaded Ends 2" and Smaller (GA4): Class 150, bronze body, screwed bonnet, non-rising stem, solid wedge. Apollo Valves, a division of Aalberts-IPS 106T. 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 CWP, bronze body, screwed bonnet, rising stem, OS&Y, solid wedge, UL-listed. Stockham B-133. Nibco T-104-0.
 7. Flanged Ends 2-1/2" and Larger (GA7): 175 CWP, iron body, bolted bonnet, rising stem, OS&Y, solid wedge, UL listed. Stockham G-634. Nibco F-607-OTS.
 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 2-1/2" and Larger (GA9): Class 250, iron body bronze mounted, bolted bonnet, rising stem, OS&Y, solid wedge. Apollo Valves, a division of Aalberts-IPS 621F. Stockham F-667. Nibco F-667-0. Crane 7-1/2E. Milwaukee F-2894.
 10. Threaded Ends 2" and Smaller (GA10): Class 300, bronze body, union bonnet, rising stem, solid wedge, renewable stainless-steel seat. Apollo Valves, a division of Aalberts-IPS 116T. Stockham B-145. Nibco T-174-SS. Crane 634E. Milwaukee 1184.
 11. Flanged Ends 2-1/2" 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 2-1/2" and Larger (GA12): 300 CWP, 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:
- A. 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.
 - B. Comply with the following standards:
 1. Cast Iron Valves: MSS SP-71. Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 2. Bronze Valves: MSS SP-80. Bronze Gate, Globe, Angle, and Check Valves.
 3. Steel Valves: ANSI B16.34. Steel Standard Class Valve Ratings.
 - C. Types of Check (CK) Valves:
 1. Threaded Ends 2" and Smaller (CK1): Class 125, bronze body, screwed cap, horizontal swing, bronze disc. Apollo Valves, a division of Aalberts-IPS 161T. 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. Apollo Valves, a division of Aalberts-IPS 161S. Stockham B-309. Nibco S-413-B. Crane 1707S. Milwaukee 1509.
 3. Flanged Ends 2-1/2" and Larger (CK3): Class 125, iron body, bronze-mounted, bolted cap, horizontal swing, cast-iron or composition disc. Apollo Valves, a division of

Aalberts-IPS 910F / 910FLFA. Stockham G-931 or G-932 as applicable. Nibco F918-B. Crane 373. Milwaukee F2974 as applicable.

4. Threaded Ends 2" and Smaller (CK4): Class 200, bronze body, screwed cap, Y-pattern swing, regrinding bronze disc. Stockham B-345. Nibco T-453-B. Crane 36. Milwaukee 518/508.
5. Flanged Ends 2-1/2" and Larger (CK5): Class 250, iron body, bronze mounted, bolted cap, cast-iron disc. Apollo Valves, a division of Aalberts-IPS 920F. Stockham F-947. Nibco F-968-B. Crane 39E. Milwaukee F2970.
6. Threaded Ends 2" and Smaller (CK6): Class 300, bronze body, screwed cap, Y-pattern swing, regrinding bronze disc. Apollo Valves, a division of Aalberts-IPS 168T. Stockham B-375. Nibco T-473-B. Crane 76E. Milwaukee 517/507.
7. Flanged Ends 2-1/2" and Larger (CK7): 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:

- A. General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.
- B. 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 PTFE seats. Valves shall be full port design unless otherwise noted. Valves 1-1/4" and larger in air and gas applications shall be conventional port design. Stem extensions shall be furnished for use in insulated piping where insulation exceeds 1/2" thickness.
- C. Comply with the following standards:
 1. MSS SP-72. Ball Valves with Flanged or Butt Welding Ends for General Service.
 2. MSS SP-110. Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- D. Types of Ball (BA) Valves:
 1. Threaded Ends 2" and Smaller (BA1): Bronze two-piece full port body with adjustable stem packing. Nibco T-585-70. Stockham S216-BR-R-T. Milwaukee BA125. Apollo Valves, a division of Aalberts-IPS 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 Valves, a division of Aalberts-IPS 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. Apollo Valves, a division of Aalberts-IPS 77G. Nibco T-585-70-UL.
 4. Flanged Ends 2-1/2" and Larger (BA4): Class 150, stainless steel full port two-piece body with adjustable stem packing. Apollo Valves, a division of Aalberts-IPS 87A-200.

2.6 Valve Features:

- A. 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.
- B. Valve features specified or required shall comply with the following:
 1. Bypass: Comply with MSS SP-45, and except as otherwise indicated, provide manufacturer's standard bypass piping and valving. Provide for gate valves 8" and larger.
 2. Drain: Comply with MSS SP-45, and provide threaded pipe plugs complying with

- applicable Division 23 pipe or tube section. Provide for gate valves 8" and larger.
3. Flanged: Provide valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).
 4. Threaded: Provide valve ends complying with ANSI B2.1.
 5. Solder-Joint: Provide valve ends complying with ANSI B16.18.
 6. 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.
 7. Non-Metallic Disc: Provide non-metallic material selected for service indicated in accordance with manufacturer's published literature.
 8. Renewable Seat: Design seat of valve with removable disc and assemble valve so disc can be replaced when worn.
 9. Extended Stem: Increase stem length by 2" minimum, to accommodate insulation applied over valve.

PART 3 - EXECUTION

3.1 Installation:

- A. 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.
- B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.
- C. 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.
- D. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:
 1. Tube Size 3" and Smaller: Threaded valves.
 2. Pipe Size 2" and Smaller: Threaded valves.
 3. Pipe Size 2-1/2" and Larger: Flanged valves.
- E. 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.
- F. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.
- G. Installation of Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction flow.
- H. Valve Tags and Valve Charts: Provide identification complying with Division 22 Common Work Results for Plumbing section "Plumbing Identification".

END OF SECTION

SECTION 22 05 26 - ACCESS DOORS

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. This section is a Division 22 Common Work Results for Plumbing section and is part of each Division 22 section making reference to or requiring access doors specified herein.

1.2 Approval Submittals:

- A. Product Data: When required by other Division 22 sections, submit product data for access doors. Submit with Division 22 section using access doors, not as a separate submittal. Include rating data.

1.3 O&M Data Submittals: Submit a copy of approval submittals. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 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.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide access doors by Milcor, Jay R. Smith, Zurn, BOICO, Elmdor, or approved equal.

2.3 Access Door Construction: Except as otherwise indicated, fabricate wall/ceiling door units of welded steel construction with welds ground smooth, 16-gauge frames and 14-gauge flush panel doors, 175° swing with concealed spring hinges, flush screw-driver-operated cam locks, factory-applied rust-inhibitive prime-coat paint finish.

2.4 Locks: Where indicated, provide flat pass key type 5-pin or 5-disc type cylinder locks, individually keyed unless otherwise indicated, 2 keys.

2.5 Locks: Provide Folger Adams or approved equal Model 415-6 high security deadlock six lever Number 12. All access doors shall be keyed the same throughout. Coordinate with the General Contractor.

2.6 Fire Rated Access Doors: Where required furnish with 20-gauge insulated sandwich panel, automatic closing mechanism, cylinder type lock (self-latching with inside release mechanism), and continuous concealed steel hinge pin. Access doors shall carry the UL 1-1/2 hour "B" label.

PART 3 - EXECUTION

3.1 Access doors shall be installed to operate and service all plumbing equipment including valves 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. Access doors shall have factory applied protective phosphate coating and baked enamel primer suitable for field painting.

3.2 Access doors shall be installed by the Division installing the substrate construction. However, the 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

SECTION 22 05 29 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. This section is a Division 22 Common Work Results for Plumbing section and is part of each Division 22 section making reference to or requiring hangers and supports specified herein.
- C. Extent of hangers and support required by this section is indicated on drawings and/or specified in other Division 22 sections.

1.2 Codes and Standards:

- A. Code Compliance: Comply with applicable codes pertaining to product materials and installation of hangers and supports.
- B. MSS Standard Compliance:
 - 1. Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.
 - 2. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - 3. Terminology used in this section is defined in MSS SP-90.
- C. UL Compliance: Provide products which are UL listed.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide supports and hangers by Grinnell, 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 the 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 support for copper-piping systems.

- A. Adjustable Steel Clevises: MSS Type 1.
- B. Steel Double Bolt Pipe Clamps: MSS Type 3.
- C. Adjustable Steel Band Hangers: MSS Type 7.
- D. Steel Pipe Clamps: MSS Type 4.
- E. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.
- F. Single Pipe Rolls: MSS Type 41.
- G. Adjustable Roller Hanger: MSS Type 43.
- H. 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 the size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

- A. Two-Bolt Riser Clamps: MSS Type 8.
- B. 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 the size of hanger-rod attachments to suit hanger

- rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- A. Steel Turnbuckles: MSS Type 13.
 - B. 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.
 - A. Center Beam Clamps: MSS Type 21.
 - B. C-Clamps: MSS Type 23.
 - C. Malleable Beam Clamps: MSS Type 30.
 - D. Side Beam Brackets: MSS Type 34.
 - E. 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.
 - A. Protection Shields: MSS Type 40, of length recommended by manufacturer to prevent crushing of insulation.
 - B. Protection Saddles: MSS Type 39, use with rollers; fill interior voids with segments of insulation matching adjoining insulation.
 - 2.7 Miscellaneous Materials:
 - A. Metal Framing: Provide products complying with NEMA STD ML 1.
 - B. Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.
 - C. 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.
 - D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes or continuous channel struts selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

- 3.1 Preparation:
 - A. 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.
 - B. 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:
 - A. 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.
 - B. 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:
 - A. 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 spacing 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.

1. Horizontal steel pipe and copper tube 1-1/2" diameter and smaller: support on 6-foot centers.
 2. Horizontal steel pipe and copper tube over 1-1/2" diameter: support on 10-foot centers.
 3. Vertical steel pipe and copper tube: support at each floor and on 10-foot centers.
 4. Horizontal PVC pipe: support on 4-foot centers.
 5. Vertical PVC pipe: support at each floor and on 10-foot centers.
 6. Non-PVC plastic pipe: support in accordance with manufacturer's recommendations.
 7. Horizontal cast iron pipe inside building: support on 5-foot centers.
 8. Vertical cast iron pipe: support at each floor and on 15-foot centers.
 9. Horizontal cross-linked polyethylene (PEX) pipe 1" diameter and smaller: support on 32-inch centers.
 10. Horizontal PEX pipe over 1" diameter: support on 4-foot centers.
 11. Vertical PEX pipe: support at each floor and on 10-foot centers.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
- C. Paint all black steel hangers with black enamel. Galvanized steel and copper clad hangers do not require paint.
- D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- E. Provision for Movement:
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.
 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. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.
- F. Insulated Piping: Comply with the following installation requirements:
1. Shields: Where low-compressive-strength insulation or vapor barriers are indicated, install coated protective shields.
 2. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
- 3.4 Installation of Anchors:
- A. 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.
 - B. Fabricate and install anchors by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
 - C. Anchor Spacing: 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.
 - D. 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:

- A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 22. 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.
- B. 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

SECTION 22 05 39 - TESTING, CLEANING, AND STERILIZATION FOR
PLUMBING PIPING

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. This section is a Division 22 Common Work Results for Plumbing section and is part of each Division 22 section making reference to or requiring the testing and other procedures specified herein.
- C. Notify the Architect/Engineer when system tests are ready to be witnessed at least 24 hours prior to the test.
- D. All materials, test equipment, and devices required for cleaning, testing, sterilizing or purging shall be provided by the Contractor.

PART 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 The 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 for each test and ensure that it is satisfactory for the period specified before calling the Architect/Engineer to observe the test. Tests 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 Repair piping systems sections which fail required piping test. Disassemble and re-install using new materials to the extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- 2.7 Pressure Test Requirements:
 - A. Soil, Waste, Vent and Acid 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.
 - B. Domestic Water, Deionized Water and Reclaim 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.

PART 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:
 - A. Prerequisites: All new hot and cold-water piping installed (complete), all fixtures connected, system flushed out, and system filled with water.
 - B. The shut off valve the point of connection 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 point of connection.
- C. 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.
 - D. 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.
 - E. The Architect/Engineer shall be notified 24 hours prior to the procedure so that it can be witnessed.
 - F. Provide sampling and certified report by an independent testing lab. Provide written Health Department approval of disinfection samples.

PART 4 - NEW INSTALLATION TESTING OF SANITARY AND STORM PIPING

- 4.1 General: Comprehensive quality assurance program including visual inspection and TV/video recordings shall be performed to ensure sewers are uniformly bedded and backfilled, all joints are properly assembled, lines have smooth and uniform interior sections with respect to surfaces, grade, and alignment, and confirm that lines are watertight within allowable limits.

END OF SECTION

SECTION 22 05 53 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. This section is a Division 22 Common Work Results for Plumbing section and is part of each Division 22 section making reference to or requiring identification devices specified herein.
- C. The extent of plumbing identification work required by this section is indicated on drawings and/or specified in other Division 22 sections.
- D. Refer to Division 26 sections for identification requirements of electrical work (not work of this section).

1.2 Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 2 - PRODUCTS

2.1 General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than a single type is specified for application, selection is the Contractor's option but provides single selection for each product category.

2.2 Painted Identification Materials:

- A. 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 3/4" high letters for access door signs and similar operational instructions.
- B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
- C. Identification Paint: Standard identification enamel.

2.3 Valve Tags:

- A. Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and 1/2" high sequenced valve numbers, and with 5/32" hole for fastener. Provide 1-1/2" diameter tags, except as otherwise indicated.
- B. 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 1/2" high sequenced valve numbers, and with 5/32" hole for fastener. Provide 1-1/2" square black tags with white lettering, except as otherwise indicated.

2.4 Engraved Plastic-Laminate Signs:

- A. 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.
- B. Thickness: 1/16" for units up to 20 square inches or 8" length; 1/8" for larger units.
- C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.5 Stamped Nameplates: Provide equipment manufacturer's standard stamped nameplates for motors, pumps, etc.

PART 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 Piping System Identification:

- A. 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:

1. Stenciled markers of black or white for best contrast.
- B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.
 1. Near each valve and control device.
 2. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at a branch where there could be question of flow pattern.
 3. Near locations where pipes pass through walls or floors/ ceilings or enter non-accessible enclosures.
 4. At access doors, manholes, and similar access points which permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced intermediately at maximum spacing of 20' along each piping run.
 7. On piping above all ceilings, except omit intermediately spaced markers.
- 3.3 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, and similar rough-in connections of end-use fixtures and units.
- 3.4 Valve Charts: Provide framed, glass-covered valve charts in each mechanical room. Identify coded valve numbers, valve function, and valve location for each valve.
- 3.5 Plumbing Equipment Identification: Install engraved plastic laminate sign on or near each major item of plumbing equipment and each operational device. The label shall indicate the type of system and area served. Provide signs for the following general categories of equipment and operational devices:
 1. Main control and operating valves, including safety devices.
 2. Meters, gages, thermometers and similar units.
 3. Electric water heaters.
 4. Pumps.
- 3.6 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all major equipment items such as motors, pumps, water heaters, 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.
- 3.7 Adjusting and Cleaning:
 - A. Relocate any plumbing identification device which has become visually blocked by work of this division or other divisions.

END OF SECTION

SECTION 22 07 16 - PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. Division 22 Common Work Results for Plumbing sections apply to the work of this section.

1.2 Approval Submittals:

- A. Product Data: Submit manufacturer's product data sheets and installation instruction on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:

- 1. Fiberglass equipment insulation.

1.3 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Knauf, Owens-Corning, Johns Manville, Certainteed, Pittsburgh Corning, or approved equal.

2.2 Flame/Smoke Ratings: Provide composite plumbing 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 E84.

2.3 Equipment Insulation Materials:

- A. Rigid Fiberglass Equipment Insulation: ASTM C612, Class 1 (non-load bearing). Boards shall be suitable for use to 400°F.
- B. Flexible Fiberglass Equipment Insulation: ASTM C553, Type I, Class B-3. Flexible blankets shall be 1 pcf density and suitable for use to 350°F.
- C. Jacketing Material for Equipment Insulation: Provide 8-ounce canvas jacket, except as otherwise indicated.
- D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics, and protective finishes as recommended by insulation manufacturer for applications indicated.
- E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 General:

- A. 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.
- B. 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.
- C. Maintain the integrity of vapor barrier on insulation and protect it to prevent puncture and other damage. Label all insulation "ASBESTOS FREE".
- D. Do not apply insulation to surfaces while they are hot or wet.
- E. Do not install insulation until the 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.

3.2 Installation of Fiberglass Equipment Insulation:

- A. Insulate the following equipment:
 - 1. Hot water expansion tank: 1" thick.
 - 2. Hot water storage heater: 2" thick.
- B. Coat insulated surfaces with a layer of insulating cement, troweled in a workmanlike manner,

leaving a smooth continuous surface. Fill in scored block, seams, chipped edges, and depressions, and cover over joints with cement of sufficient thickness to remove surface irregularities. Cover insulated surface with glass cloth jacketing neatly fitted and firmly secured. Lap seams at least 2 inches. Apply over vapor barrier where applicable.

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. Division 22 Common Work Results for Plumbing sections apply to the work of this section.

1.2 Approval Submittals:

- A. Product Data: Submit manufacturer's product data sheets and installation instruction on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:

- 1. Fiberglass pipe insulation.
- 2. Cellular glass pipe below-ground insulation.

1.3 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Knauf, Owens-Corning, Johns Manville, Certainteed, Pittsburgh Corning, U.S. Rubber, or approved equal.

2.2 Flame/Smoke Ratings: Provide composite plumbing 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 E84.

2.3 Pipe Insulation Materials:

- A. Fiberglass Pipe Insulation: ASTM C547, Class 1 unless otherwise indicated (preformed sleeving with white all-service jacket, suitable for temperatures up to 450°F).
- B. Cellular Glass Pipe Insulation: ASTM C552, Type II, Class 1 (uncovered).
- C. Flexible Unicellular Pipe Insulation: ASTM C534, Type I (tubular, suitable for use up to 200°F).
- D. Staples, Bands, Wires, and Cement: As recommended by the insulation manufacturer for applications indicated.
- E. Adhesives, Sealers, Protective Finishes: Products recommended by the insulation manufacturer for the application indicated.
- F. 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.

PART 3 - EXECUTION

3.1 General:

- A. 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.
- B. 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.
- C. Maintain the integrity of vapor barrier on insulation and protect it to prevent puncture and other damage. Label all insulation "ASBESTOS FREE".
- D. Do not apply insulation to surfaces while they are hot or wet.
- E. Do not install insulation until the 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.
- F. Do not install insulation on pipe systems until acceptance tests have been completed except for flexible unicellular insulation. Do not install until the building is "dried-in".

3.2 Installation of Fiberglass Pipe Insulation:

- A. Insulate the following piping systems:

1. Domestic hot water: up to 3" pipe = 1-1/2" thick; over 3" pipe = 2" thick.
 2. Cold water pipe: 1/2" thick.
 - B. 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 a heavy coat of general-purpose mastic. Premolded PVC covers may also be used, but no flexible inserts are allowed.
 - C. 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.
 - D. Omit insulation on unions, flanges, strainer blowoffs, flexible connections, expansion joints, and exposed plumbing fixture run-outs from faces of wall or floor to fixture.
 - E. Outdoor Locations: Cover straight piping with 0.016" thickness smooth aluminum jacket fastened with aluminum bands on not over 12" centers. Use factory-made 0.014" aluminum covers for fittings and valves. Metal jacketing shall be applied with the longitudinal seam positioned to shed water.
- 3.3 Installation Cellular Glass Pipe Insulation (Below-Ground):
- A. Insulate the following piping systems:
 1. Domestic cold water: smaller than 6" pipe = 1-1/2" thick; 6" and larger pipe = 2" thick.
 - B. Cut insulation in sections and carefully fit to the pipe and fittings. Apply vapor barrier mastic to all edges of the cellular insulation and between joints in the insulation. Wire the cellular glass in place with stainless steel wire 9 inches on center. Finish with a prefabricated water barrier self-sealing jacket similar to Pittsburgh Corning "Pittwrap SSII", 70 mils thickness. Insulate all anchors, guides, wall penetrations, expansion joints, loops and ells in accordance with the manufacturer's recommendations. Use rubber spacers at all expansion fittings.
- 3.4 Installation of Flexible Unicellular Pipe Insulation:
- A. Insulate the following piping systems:
 1. Horizontal above-grade waste piping receiving condensate from air conditioning units to points of connection receiving waste from fixture to 6" past P-trap 1/2" thick.
 2. Floor drain bodies located above ceiling or above-grade to 6" past P-trap 1/2" thick.
 - B. Apply insulation in accordance with the manufacturer's recommendations and instructions. Miter cut insulation to fit pipe fittings. Use approved cement to seal all joints and ends in the insulation.
 - C. Insulation outside the building shall be protected by a smooth 0.016" thickness aluminum jacket secured with aluminum bands on 12" centers. All joints in metal jacketing (longitudinal and transverse) shall be sealed with silicone sealant.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. Division 22 Common Work Results for Plumbing sections apply to work of this section.
- C. Extent of domestic water piping work is indicated on drawings and schedules, and by requirements of this section.
- D. Refer to appropriate Division 2 sections for exterior domestic water piping (not work of this section unless noted).
- E. Refer to other Division 22 sections for insulation of domestic water piping (not work of this section).
- F. Refer to other Division 22 sections for excavation and backfill required in conjunction with domestic water piping.

1.2 Codes and Standards: Comply with applicable portions of Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products. Comply with local utility requirements.

- A. Any material or equipment used in any potable water system intended for human consumption, including inline devices (i.e. valves, fittings, pumps, meters) and end point devices (ie. drinking water fountains, faucets, ice makers, supply stops, control valves for dispensing), shall be certified "lead-free" in accordance with NSF/ANSI 61.

1.3 Approval Submittals:

- A. Product Data: Submit manufacturer's product data for:

- 1. Valves.
- 2. Balancing valves.
- 3. Dielectric unions.
- 4. Strainers.
- 5. Hose bibbs.
- 6. Wall hydrants.
- 7. Backflow preventers.
- 8. Pressure reducing valves.
- 9. Pressure regulating valves.
- 10. Meters and gauges.
- 11. Master mixing valves.
- 12. Relief valves.
- 13. Water hammer arrestors.
- 14. Trap primers.
- 15. Access doors.

1.4 Test Reports and Verification Submittals:

- A. Backflow Preventer Test Report: Submit Test Report for each backflow preventer.
- B. Disinfection: Submit report by Health Department.

1.5 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts list for valves, backflow preventers, pressure regulating valves, trap primers. Include in O&M Manual.

PART 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 Uniform Plumbing Code 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 Basic Identification: Provide identification complying with Division 22 Common Work Results for Plumbing section "Plumbing Identification".
- 2.3 Basic Pipes and Pipe Fittings: Provide pipes and pipe fittings in accordance with the following listing:
- A. Interior Water Piping:
1. Above Grade: ASTM B88 copper tube, Type L, hard-drawn temper with ANSI B16.29 wrought-copper fittings and soldered joints.
 2. Below Grade: ASTM B88 copper tube, Type L, soft-annealed temper; no joints below floor.
- B. Exterior Water Piping:
1. Polyvinyl Chloride Pipe (PVC): ASTM D1785 Schedule 40 or Schedule 80 with ASTM D2466 Schedule 40 socket or ASTM D2467 Schedule 80 socket fittings and solvent cement joints.
- C. Soldered Joints: Tin-Antimony (95-5) solder, ASTM B32, Grade 95TA.
- 2.4 Sleeves and Sleeve Seals: Provide sleeves and sleeve seals complying with Division 22 Common Work Results for Plumbing section "Sleeves and Sleeve Seals".
- 2.5 Basic Hangers and Supports: Provide hangers and supports complying with Division 22 section "Hangers and Supports".
- 2.6 Interior Valves: Provide valves complying with Division 22 Common Work Results for Plumbing section "Valves" and the following list:
- A. Sectional and Shutoff Valves: Type GA1, GA2, GA3, BA1, BA2.
- B. Drain Valves: Type GA1, GA2, BA1, BA2.
- C. Throttling Valves: Type GL1, GL2, GL6, BA1, BA2.
- D. Check Valves: Type CK1, CK2, CK3.
- 2.7 Balancing Valves: Provide balancing valves as indicated, of one of the following types:
- A. Threaded Ends 2" and Smaller: Class 125, copper alloy, bronze plug, straight or angle pattern with fixed orifice, multi-turn throttling adjustment with integrated setpoint indicator, dual differential pressure test ports.
- B. Soldered Ends 2" and Smaller: Class 125, copper alloy, bronze plug, straight or angle pattern with fixed orifice, multi-turn throttling adjustment with integrated setpoint indicator, dual differential pressure test ports.
- C. Flanged Ends 2-1/2" and Larger: Class 125, ductile or cast-iron body with fusion bonded epoxy coating, straight or angle pattern with fixed orifice, multi-turn throttling adjustment with integrated setpoint indicator, dual differential pressure test ports.
- D. Acceptable Manufacturers: Subject to compliance with requirements, provide balancing valves by Apollo Valves, Bell & Gossett, IMI-TA/Victaulic, Taco, or approved equal.
- 2.8 Dielectric Unions: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.
- 2.9 Low Pressure Y-Type Pipeline Strainers:
- A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Provide Type 304 stainless steel screens. Select for 200 psi working pressure (water, oil or gas). Provide 20 mesh screens through 2" size and 1/16" perforations for 2-1/2" size and larger.
- B. Select from the following types:
1. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered

- blowdown fitted with pipe plug.
- 2.10 Hose Bibbs: Provide chrome plated hose bibbs with lock shield compression stop and removable handle, solid flange, female connection with 3/4" male threaded hose end, and straight line type non-removable vacuum breaker with 3/4" male threaded hose end. Vacuum breakers shall conform to ASME A112.21.3 and ASSE 1011. Woodford Model 24, or equal model by Acorn or Wade.
- 2.11 Non-freeze Wall Hydrants: Provide 3/4" anti-syphon, non-freeze wall hydrant with bronze casing, satin bronze box, straight inlet connection, and integral vacuum breaker-backflow preventer. Vacuum breakers shall conform to ASME A112.21.3 and ASSE 1019. Wade W-8700 or approved equal.
- 2.12 Pressure Regulating Valves: Provide pressure regulating valves, single seated, direct operated type, bronze body, integral strainer, complying with requirements of ASSE Standard 1003. Size for maximum flow rate and the inlet and outlet pressures indicated on drawings. Apollo Valves, Cash, Cla-Val, Watts, or approved equal.
- 2.13 Meters and Gauges: Provide meters and gauges complying with Division 22 Common Work Results for Plumbing section "Meters and Gauges", in accordance with the following listing:
- A. Thermometers.
 - B. Pressure gauges.
 - C. Gauge connector plugs.
- 2.14 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. Apollo Valves, Watts, Cash, Zurn, or approved equal.
- 2.15 Water Hammer Arrestors: Provide bellows type water hammer arrestors, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201 and ASSE 1010. Precision Plumbing Products, Josam, Zurn, Amtrol, Wade, Jay R. Smith, or approved equal.
- 2.16 Trap Primers: Provide brass trap primers and distribution units to seal floor drains indicated on drawings. Trap primer valves shall be automatic, self-contained type with no springs or diaphragms and shall not require adjustment. Trap primer valves shall be the type that can be installed anywhere on cold water piping. Distribution units shall supply 1-4 floor drains. Trap primer valves shall comply with ASSE 1018. Wade 4402-NL-DU/IPS, Precision Plumbing Products PR-500, or approved equal. Where P-trap primers are indicated use Wade 4401, "Prime-Eze" by Jay R. Smith, or approved equal.
- 2.17 Access Doors: Provide access doors to service all valves and other devices as required in accordance with Division 22 Common Work Results for Plumbing section "Access Doors".

PART 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 Installation of Domestic Water Piping:
- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof 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.
 - B. Comply with ANSI B31 Code for Pressure Piping.
 - C. 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 1/2" 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.

- D. 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.
- E. 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.
- F. Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with building construction and installed work.
- G. Install eccentric reducers where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush. Do not use bushings.
- H. Install piping with 1/32" per foot (1/4%) upward slope in direction of flow, or as indicated on the drawings. The intent is to install piping sloped to drains at low points in the system for a drainable system.
- I. Connect branch-feed piping to mains at horizontal center line of mains, connect run-out piping to branches at horizontal center line of branches.
- J. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- K. Install piping to allow for expansion and contraction.
- L. 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 Installation of Piping System Joints: Provide joints of the type indicated in each piping system.
 - A. 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 ASTM B13, water-flushable / 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 according to ASTM B828 or Copper Tube Handbook by CDA. Wipe excess solder from joint before it hardens.
- 3.4 Install hangers and supports in accordance with Division 22 Common Work Results for Plumbing section "Hangers and Supports".
- 3.5 Install valves in accordance with Division 22 Common Work Results for Plumbing section "Valves".
 - A. 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.
 - B. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
 - C. 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 domestic water piping system.
 - D. Check Valves: Install on discharge side of each pump, and elsewhere as indicated.
- 3.6 Balancing Valves: Install balancing valves on discharge of each plumbing pump, in each hot water recirculating loop, and elsewhere as indicated. Install with readout valves in vertical upright position. Maintain minimum length of straight unrestricted piping equivalent to three

- pipe diameters upstream of valve.
- 3.7 Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.
- 3.8 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 blowdown connection, full size of connection. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blowdown connection.
Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment: pumps and temperature or pressure regulating valves.
- 3.9 Hose Bibbs and Wall Hydrants: Install on concealed piping where indicated with vacuum breaker. Mount 18 inches above grade or finished floor.
- 3.10 Pressure Regulating Valves: Install where indicated. Provide inlet and outlet shutoff valves, and throttling valve bypass. Provide pressure gauge on valve outlet.
- 3.11 Master Mixing Valves: Install Master mixing valves for domestic hot water systems in accordance with manufacturer's installation instructions. Provide inlet and outlet shutoff valves.
- 3.12 Meters and Gauges: Install in accordance with Division 22 Common Work Results for Plumbing section "Meters and Gauges".
- 3.13 Relief Valves: Install 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.
- 3.14 Piping Run-outs to Fixtures: Provide hot and cold water piping run-outs to fixtures of sizes indicated, but in no case smaller than required by Uniform Plumbing Code.
- 3.15 Water Hammer Arrestors: Install in upright position, in locations and of sizes indicated in accordance with PDI Standard WH-201.
- 3.16 Air Chambers: Install at each fixture (or group of fixtures if the farthest fixture is within 6 feet of an air chamber). Air chambers shall be 20 pipe diameters long, but in no case less than 12 inches long.
- 3.17 Trap Primers: Install as indicated, and in accordance with manufacturer's installation instructions. Provide access panels to all trap primers unless accessible through a lay-in ceiling.
- 3.18 Access Doors: Locate and coordinate installation of access doors for all valves and devices in accordance with Division 22 Common Work Results for Plumbing section "Access Doors".
- 3.19 Piping Tests: Test, clean, and sterilize domestic water piping in accordance with requirements of Division 22 Common Work Results for Plumbing section "Testing, Cleaning, and Sterilization for Plumbing Piping".

END OF SECTION

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. Division 22 Common Work Results for Plumbing sections apply to the work of this section.
- C. The extent of sanitary waste and vent piping work is indicated on drawings and schedules, and by requirements of this section.
- D. Refer to other Division 22 sections for the insulation of sanitary waste piping (not work of this section).
- E. Refer to other Division 22 sections for excavation and backfill required in conjunction with sanitary waste piping.

1.2 Codes and Standards: Comply with applicable portions of Uniform Plumbing Code pertaining to selection and installation of plumbing materials and products. Comply with local utility requirements.

1.3 Approval Submittals:

A. Product Data: Submit manufacturer's product data for:

1. Cleanouts.
2. Floor drains.
3. Trap seal protection.
4. Sand interceptors

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts list for sand interceptors. Include in O&M Manual.

PART 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 sanitary waste 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 Basic Identification: Provide identification complying with Division 22 Common Work Results for Plumbing section "Plumbing Identification."

2.4 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".

2.5 Basic Pipes and Pipe Fittings: Provide pipes and pipe fittings in accordance with the following listing:

A. Above Ground Sanitary Waste and Vent Piping:

1. ASTM D2665 Schedule 40 polyvinyl chloride plastic pipe (PVC), Type DWV, with PVC plastic type DWV socket-type fittings, solvent cement joints, in applications that will not exceed 140°F. Do not use in fire-rated assemblies or return air plenums.

B. Underground Building Drain Piping (within 5 feet of the building):

1. ASTM D2665 Schedule 40 polyvinyl chloride plastic pipe (PVC), Type DWV, with PVC plastic type DWV socket-type fittings, compression gasket joints, in applications that will not exceed 140°F.

- 2.6 Pipe Sleeves and Seals: Provide pipe sleeves and seals complying with Division 22 Common Work Results for Plumbing section "Sleeves and Sleeve Seals".
- 2.7 Basic Hangers and Supports: Provide supports and anchors complying with Division 22 Common Work Results for Plumbing section "Hangers and Supports".
- 2.8 Cleanouts: Provide factory-fabricated drainage piping products of sizes 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, Sioux Chief, Zurn.
 - A. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1 countersunk head.
 - B. Cleanout for PVC Systems:
 - 1. Floor Cleanouts: Cast-iron body with adjustable head, brass plug, and scoriated nick-brass cover. Furnish with carpet marker or flange style for carpeted floors as recommended by Architect. Furnish with recessed cover for tile floors. Furnish with clamping ring for floors with membrane. Sioux Chief 854 Series hub outlet for push-on.
 - 2. Cleanouts in Piping: PVC cleanout adaptor with threaded PVC plug.
 - 3. Wall Cleanouts: PVC cleanout adaptor with tapped, countersunk, threaded brass plug and round stainless steel access cover with screw. Sioux Chief 873 Series.
 - 4. Grade Cleanouts: PVC cleanout adaptor with countersunk, threaded brass plug. Sioux Chief 853 Series. In sidewalks and other finished concrete, provide access cover frames with a non-tilting tractor cover. Sioux Chief 850 Series.
 - 5. Cleanouts in Paved Areas: Cast iron body, adjustable housing, ferrule with plug and round loose scoriated tractor cover. Sioux Chief 850 Series. Coordinate concrete depth at site with adjustable flange.
- 2.9 Floor Drains: Provide floor drains of size as indicated on drawings and type, including features, as specified herein. Floor drains shall conform to ASME A112.3.1 or ASME A112.6.3. Josam, Jay R. Smith, Sioux Chief, Zurn.
 - A. 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.
 - B. Strainer: Provide 5" satin-nickel bronze strainer.
 - C. Trap Seals: Provide trap seal protection in accordance with ASSE 1072. TrapShield by Sioux Chief 835 Series.
 - D. Trap Primer Connection: Provide 1/2" trap primer tapping.
- 2.10 Sand Interceptors: Provide horizontal, atmospheric sand interceptors designed for intermittent variable flows of any mixture of water-sand at 40°F – 140°F. The interceptor shall be suitable for outdoor above-grade or below-grade installations. Interceptor shall be built in accordance with ASCE/SEI 7 for direct burial. Provide the following features:
 - A. Field-cut riser system.
 - B. Built-in flow control and test / sealing caps.
 - C. Access covers with water / gas tight seal.
 - D. Vent fittings, pumpout port.
 - E. Acceptable Manufacturers: Striem model CB, or approved equal.

PART 3 - EXECUTION

- 3.1 General: Examine substrates and conditions under which sanitary waste and vent 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 22 Common Work Results for Plumbing section "Plumbing Identification".
- 3.3 Piping Installation:
 - A. General:

1. Install above-grade sanitary waste and vent piping in accordance with the Uniform Plumbing Code and recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings.
2. Install underground sanitary waste piping as indicated and in accordance with Uniform Plumbing Code. 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. Install building sanitary waste and vent piping pitched to drain at minimum slope of 1/4" per foot (2%) for piping 3" and smaller, and 1/8" per foot (1%) for piping 4" and larger.
4. 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 1/2" 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.
- B. Underground Piping: Provide plastic tape markers over all underground piping. Provide copper wire over all underground plastic piping. Locate markers 18" above piping.
- C. 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.
- D. 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.
- E. Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with building construction and installed work.
- F. Install eccentric reducers where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush. Do not use bushings.
- G. Connect branch-feed piping to mains at horizontal center line of mains, connect run-out piping to branches at horizontal center line of branches.
- 3.4 Installation of Piping System Joints: Provide joints of the type indicated in each piping system.
 - A. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut the 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.
 - B. Plastic Pipe Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards.
 1. Solvent-cemented joints shall be made in accordance with ASTM D2235 and ASTM F402.
 2. PVC sewer pipe bell/gasket joints shall be installed in accordance with ASTM D2321.
- 3.5 Install pipe sleeves and seals in accordance with Division 22 Common Work Results for

- Plumbing section "Sleeves and Sleeve Seals".
- 3.6 Install hangers and supports in accordance with Division 22 Common Work Results for Plumbing section "Hangers and Supports".
- A. Support all overhead P-traps with trapeze hangers and U-bolt camps.
- 3.7 Installation of Cleanouts: Install in above ground piping and building drain piping as indicated, as required by Uniform Plumbing Code, 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 waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.
- A. 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.
- B. Install cleanouts to allow adequate clearance for rodding.
- C. Protect all finished surfaces of cleanouts with a suitable adhesive covering until construction is completed.
- D. 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.
- E. Cleanouts in Paved Areas: Provide concrete pad similar to cleanout to grade and coordinate concrete depth at site with adjustable flange. Access cover frames are required.
- 3.8 Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.
- 3.9 Vent Flashing Sleeves: Install on stack passing through roof, secure to stack flashing in accordance with manufacturer's instructions.
- 3.10 Installation of Floor Drains: Install floor drains in accordance with manufacturer's written instructions and in locations indicated.
- A. Coordinate flashing work with work of waterproofing and adjoining substrate work.
- B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
- C. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
- D. Position drains so that they are accessible and easy to maintain.
- 3.11 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.
- 3.12 Piping Runouts to Fixtures: Provide sanitary waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated, but in no case smaller than required by Uniform Plumbing Code.
- 3.13 Sand Interceptors: Install sand interceptors and gauging in accordance with the manufacturer's printed instructions.
- A. Provide 12 inches of clean compacted sand below the tank for bedding.
- B. Handle tank with care when placing.
- C. Anchor tank to concrete base as indicated. Tanks shall be surrounded by at least six inches of clean sand tamped into place.
- D. Tank Cover: For tanks subject to traffic, provide at least two feet of earth cover plus six inches of reinforced concrete (or eight inches of asphaltic concrete) extending horizontally one foot beyond the tank outline.
- 3.14 Piping Tests: Test, clean, and sterilize sanitary waste piping in accordance with requirements of Division 22 Common Work Results for Plumbing section "Testing, Cleaning, and Sterilization for Plumbing Piping".

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. Division 22 Common Work Results for Plumbing sections apply to work of this section.
- C. Extent of plumbing fixtures work is indicated on drawings and schedules, and by requirements of this section.

1.2 Codes and Standards:

- A. Plumbing Fixture Standards: Comply with applicable portions of Uniform Plumbing Code pertaining to materials and installation of plumbing fixtures.
- B. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.
- C. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
- D. UL Listing: Construct plumbing fixtures requiring electrical power in accordance with UL standards and provide UL-listing and label.
- E. AHRI Compliance: Construct and install water coolers in accordance with AHRI Standard 1010 "Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers", and provide Certification Symbol.
- F. ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Accessible and Usable Buildings and Facilities".
- G. NSF Compliance: Faucets and fixture fittings that supply drinking water for human ingestion shall conform to the requirements of NSF 61, Section 9.

1.3 Approval Submittals:

- A. 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, rough-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 identified. Each fixture package shall include all of the required fittings and trim, even if such devices are used for more than one fixture.

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts list for each type of plumbing fixture and accessory, including troubleshooting maintenance guide. Include in O&M Manual.

1.5 Handle all plumbing fixtures carefully to prevent breakage, chipping, and scoring fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to the equipment manufacturer.

PART 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 manufacturers, and as required for complete installation. Where more than one type is indicated, selection is Installer's option; however, 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:

- A. 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.

- B. 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.
 - C. 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.
 - D. Stainless Steel Sheets: ASTM A167, Type 302/304, hardest workable temper. Finish shall be No. 4, bright, directional polish on exposed surfaces.
 - E. 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 C554.
 - F. Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.
- 2.4 Plumbing Fittings, Trim and Accessories:
- A. General: Faucets and fixture fittings shall conform to ASME A112.18.1.
 - B. 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.
 - 1. Automatic Faucets: Provide self-generating EcoPower sensor faucets with capacitive storage, or hard-wired equal. Faucets shall be designed for flow rate of 0.5 gpm (0.08 gallons per cycle for 10 seconds) and be equipped with self-programming micro sensor positioned at the spout for accurate hand detection. Faucet shall include vandal-resistant aerator. When using hard-wired faucets, provide a box-mounted, hard-wired transformer (120 VAC primary - 24 VAC secondary) with each faucet. All wiring and electrical connections shall be provided by Division 26. Basis of design specified on drawings does not require electrical connection; the contractor shall coordinate and provide any electrical work for a fully functional system.
 - 2. Aerators: Provide aerators of types approved by Health Department having jurisdiction.
 - 3. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: American Standard, Chicago Faucet Co., Symmons, Kohler Co., Speakman Co., TOTO USA, T & S Brass and Bronze Works.
 - C. Stops: Provide chrome-plated brass, angle type, manual shutoff valves and d" chrome-plated flexible supply pipes to permit fixture servicing without shutdown of water supply piping systems for all fixtures. Coordinate with fixture requirements.
 - 1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Sioux Chief, or approved equal.
 - D. 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.
 - 1. Provide chrome-plated cast-brass P-traps and drains with cleanout.
 - 2. P-traps, wastes, and drains of all types shall be 17-gauge.
 - 3. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Sioux Chief, or approved equal.
 - E. Flush Valves: Provide quiet-flush, chrome-plated, cast-brass flush valves with vacuum breaker and screwdriver stop in compliance with ASSE 1037. Vacuum breakers shall conform to the performance requirements of ASSE 1001. Where accessible service is indicated, provide ADA compliant handles with the handle on the wide side of the stall.
 - F. 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.

1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Josam, Sioux Chief, Zurn, J.R. Smith.
- G. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
- H. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated brass escutcheons with friction clips.
- I. Comply with additional fixture requirements listed for each fixture and as required for a complete and functional system.
- 2.5 Water Closets:
 - A. General: Provide white china siphon jet type unless otherwise noted, and in compliance with ASME A112.19.2 or ASME A112.19.3.
 1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: American Standard, Kohler, TOTO.
 - B. Fixture Seats: Provide white, heavy molded plastic fixture seats with stainless steel self-sustaining check hinges.
 1. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Bemis Mfg. Co., Beneke Corp., Church, Sperzel, Olsonite, TOTO.
- 2.6 Urinals:
 - A. General: Provide white china siphon jet wall hung type with 3/4" top spud and 2" outlet unless otherwise noted. Provide short foot carrier with top and bottom hanger plates. Urinals shall conform to ASME A112.19.2 or ASME A112.19.19.
 - B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: American Standard, Kohler, TOTO.
- 2.7 Lavatories:
 - A. General: Provide white china lavatories in compliance with ASME A112.19.1, ASME A112.19.2, or ASME A112.19.3.
 - B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: American Standard, Kohler, TOTO.
- 2.8 Drinking Fountain:
 - A. General: Provide bi-level, wall-mounted, vandal resistant, stainless steel drinking fountain with entire water system free of lead, rated for outdoor use, and round bowl. All joints shall be made using silver solder. The cabinet shall be stainless steel. The top shall be fabricated of stainless steel. Coordinate finish color with architect. Unit shall be powder coated if colored. Provide sensors, operator, transformer, and all related controls for manual operation. Units shall be ADA compliant. Provide two-valve freeze resistant fixture w/ leaf and debris strainer and mounting plate.
 - B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Elkay Mfg. Co., Murdock, Barco Products, or engineer approved equal.
- 2.9 Mop Receptors:
 - A. General: Provide one-piece mop receptors with 3" integral stainless steel grid drain. Provide wall-mounted faucet with arm handles, vacuum breakers, stops, hose connection, and hose bracket. Provide 30" hose.
 - B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Stern-Williams Co., Fiat.
- 2.10 Service Sinks:

- A. General: Provide acid resistant service sinks with back and wall hangers. Provide double faucet with bucket hook, vacuum breaker, stops and hose end. Provide 3" trap to wall, enameled inside, painted outside with foot support. Provide stainless steel rim guard. Paint outside of sink and trap black.
 - B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: American Standard, Fiat Products, Kohler Co., Stern-Williams Co.
- 2.11 Floor Drains:
- A. General: Provide 12" round large capacity floor drain with cast iron body and sediment bucket. Provide sediment bucket with no holes in the bottom of the bucket. Provide holes in sides of bucket only. Provide nickel bronze top grate.
 - B. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item: Jay R. Smith, Mifab, or engineer approved equivalent.

PART 3 - EXECUTION

3.1 General:

- A. Examine rough-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 a manner acceptable to Installer.
- B. Install plumbing fixtures of types indicated where shown and at indicated heights. Install in accordance with fixture manufacturer's written instructions, rough-in drawings, and with recognized industry practices. Install in accordance with ADA and applicable accessible code requirements. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the Uniform Plumbing Code pertaining to installation of plumbing fixtures. Furnish templates for cut-outs in countertops. Coordinate exact fixture locations with countertop shop drawings.
- C. 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.
- D. Install stop valve in water supply to each fixture.
- E. After fixtures are set, the crack between the fixture and wall shall be caulked with DAP silicone-based caulking, or approved equal.
- F. Protect installed fixtures from damage during the remainder of construction period.
- G. 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.
- H. 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.
- I. Clean plumbing fixtures, trim, aerators, and strainers of dirt and debris upon completion of installation.
- J. Adjust water pressure at drinking fountains, faucets, and flush valves to provide proper flow stream and specified gpm.
- K. Adjust or replace washers to prevent leaks at faucets and stops.

END OF SECTION

SECTION 23 00 00 - HVAC GENERAL

PART 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. The work shall include but shall not be limited to the following:
Provide all HVAC (Heating, Ventilating, and Air Conditioning) and associated controls systems for the project. Fully coordinate all mechanical requirements with work by other Divisions under this construction contract. All systems shall be complete and fully functional.
- 1.2 Related Documents:
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
 - B. Provisions of this section apply to the work of all Division 23 sections.
 - C. Review all other contract documents to be aware of conditions affecting work herein.
- 1.3 Definitions:
 - A. Provide: Furnish and install, complete and ready for intended use.
 - B. Furnish: Supply and deliver to the project site, ready for subsequent requirements.
 - C. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- 1.4 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for Division 23 work and pay all fees and charges incidental thereto.
- 1.5 Verification of Owner's Survey Data: Prior to commencing any work, the Contractor shall verify the accuracy of all survey 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, such items shall immediately be notified to the Architect/Engineer so that proper adjustments can be anticipated and ordered. Commencement by the Contractor of work shall be held as an acceptance of the data after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions or inaccuracies of the said data.
- 1.6 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All materials shall be stored to provide protection from the weather and accidental damage.
- 1.7 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be construed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.
- 1.8 Field Measurements and Coordination:
 - A. 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. Report conflicts prior to start of work.
 - B. Verify all field dimensions and locations of equipment to ensure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.
 - C. Coordinate work in this division with all other trades in proper sequence to ensure that the total work is completed within the contract time schedule and with minimum cutting and patching.
 - D. Locate all equipment, ductwork, piping, and 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. Provide all required work clearances as defined by code and manufacturer's recommendations.

- E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.
 - F. Carefully examine any existing conditions, piping, ductwork, 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 by the Engineer to resolve discrepancies.
 - G. 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. The contractor is responsible for the accuracy of his measurements and for coordination with all trades. Contractors shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or material cannot be fitted, the 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.
- 1.9 Guarantee and Service:
- A. The Contractor shall guarantee labor, materials and equipment for a period of one (1) year from Substantial 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. Manufacturer warranties do not relieve the Contractor of this responsibility.
 - B. The owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding the Contractor's Guarantee Bond or relieving Contractor of his responsibilities during guarantee period.
 - C. The contractor shall provide service of all new equipment during the guarantee period without additional expense to the Owner.
- 1.10 Approval Submittals:
- A. Shop drawings, product literature, and other approved 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. Submittals shall include all applicable items referenced in each specification section, and not include items from more than one specification section in the same submittal.
 - 2. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control numbers, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approved stamps. A sample cover sheet is included at the end of this section.
 - 3. 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.
 - 4. Submittals shall be combined into a single submittal package with a table of contents. Submittals shall not be issued as multiple individual submittal packages.
 - 5. 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.

- B. Before ordering any materials or equipment, and within 30 days after the award of the contract, the Contractor shall submit to the Architect/Engineer one complete schedule showing the make, type, manufacturer's name and trade designation of all equipment.
 - 1. This schedule shall be accompanied by the required number of copies of the manufacturer's printed specifications and shop drawings for each piece of equipment or specialty and shall give dimensions, diagrams, descriptive literature, capacity or rating, kind of material, finish, guarantee, etc., and such other detailed information as the Architect/Engineer may require.
 - 2. When approved, such schedule shall be an addition to these specifications and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.
- C. If the shop drawings show variation from the requirements of the contract documents, the Contractor shall make specific mention of such variation in his letter of transmittal. If acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.
- D. Review of shop drawings, descriptive 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 such deviation at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, descriptive 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.
- E. Submit shop drawings and any other drawings called for in other sections. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than 1/4" 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.
- F. Submit product data after the award of the contract and before any equipment or materials are purchased. Product data are defined as manufacturer's printed literature specifically marked to indicate size and model and accompanied by rating sheets listing values showing that equipment meets scheduled or specified values. A properly coded stamp from the Engineer on returned submittal is required before ordering equipment.
- G. Coordinate with other divisions supplying equipment prior to submitting shop drawings.
- H. Shop drawings shall be submitted in one package unless approved otherwise by the Engineer. Provide an index of sections listing manufacturers and "as-specified" or not. Each specification section shall be tabbed with equipment inserted.
- 1.11 Test Reports and Verification Submittals: Submit test reports, certifications and verification letters as called for in other sections. The contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, review the reports, and take corrective action within the scheduled contract time.
- 1.12 O&M Data Submittals: Submit Operations and Maintenance data as called for in other sections when a copy of approved submittals is included in the O&M Manual, only the final "Furnish as Submitted" or "Furnish as Corrected" copy shall be used. The contractor shall organize these later 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.

PART 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. 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:

- A. Equipment and materials 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 equipment or materials.
- B. Each item of equipment shall bear a nameplate 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.
- C. The label of the approving agency, such as UL, ASME, AHRI, or AMCA, by which a standard has been established for each particular item, shall be in full view.
- D. 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.
- E. A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.
- F. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.
- G. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material and type of construction desired. The 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 meet detailed specifications and that size and arrangement of the equipment are suitable for installation.
- H. 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 equipment and materials in accordance with the written description of each item and with the intent of the drawings and specifications.

2.3 Requests for Substitution:

- A. 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. Other systems, products, equipment or materials may be accepted only if in the opinion of the Engineer, that they are equivalent in quality and workmanship and will perform satisfactorily its intended purpose. The Engineer shall approve all such substitutions in materials or equipment in writing. This shall occur prior to bidding.
- B. In making requests for substitutions, the Contractor shall list the particular system, product, equipment or material he wishes to substitute and, at bid time, the Contractor shall state the amount he will add or deduct from his base bid if the substitution is approved by the Engineer. If the Contractor allows no deduction or addition to the base bid for such substitution, it shall be stated on the request.
- C. Requests by the Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.
 - 1. Required product cannot be supplied in time for compliance with Contract time requirements.
 - 2. The 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 disabilities as certified by the Contractor.
3. Substantial cost advantages are offered to the Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation and other necessary services and similar considerations.
- D. All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences and omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include, but not limited to, data as follows for both the specified and substituted products:
1. Principle of operation.
 2. Materials of construction or finishes.
 3. Thickness or gauge of materials.
 4. Weight of item.
 5. Deleted features or items.
 6. Added features or items.
 7. Changes in other work caused by the substitution.
 8. Performance and rating data.
- E. If the approved substitution contains differences or omissions not specifically called to the attention of the Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products at the Contractor's expense.
- 2.4 Prior Approval: Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences between the specified and proposed product following the guidelines for substitution herein. This requirement may be waived if, in the opinion of the Engineer, it is in the best interest of the Owner. Submittals received after the award of the bid for equipment that has not been Prior Approved shall be subject to immediate rejection.
- PART 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:
- A. 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.
 - B. Any additional steel support 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.
 - C. It shall be the Contractor's responsibility to verify 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.
 - D. All connections to devices 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.
 - E. The Contractor shall protect equipment, material, and fixtures at all times during storage and construction. The Contractor shall replace all equipment, material, and fixtures which are damaged as a result of inadequate protection.
 - F. Prior to starting and during progress of work, examine work and materials installed by others as

- they apply to work in this division. Report on conditions which will prevent satisfactory installation.
- G. 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 disconnection 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: Contractor shall be responsible for cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under these Specifications. 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. If corrosion is found to be extensive by the Engineer, the equipment shall be removed and replaced with factory new at the expense of the Contractor.
- 3.8 Cleanup: 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 Startup and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, startup shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in startup check.
- 3.10 Record Drawings:
- A. During the progress of the work, the Contractor shall record on his 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.
- B. 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:
- A. Request inspections as required under the Supplementary or General Conditions. Conceal no work until inspected.
- B. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed. The Contractor shall pay, at the Engineer's current billing rate, for additional field time required by the Engineer to report or check on previous punch list deficiencies.
- C. Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.
- D. Operation and Maintenance Manuals: Furnish complete manuals electronically and organized by system or section. Manuals shall contain:
1. Detailed operating instructions and instructions for making minor adjustments.

2. Complete wiring and control diagrams.
 3. Routine maintenance operations.
 4. Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
 5. Copies of approved submittals.
 6. Copies of all manufacturers' warranties.
 7. Copies of test reports and verification submittals.
- E. Test and Balance Report: Submit electronic copies. Report shall be submitted for review prior to Substantial Completion, unless otherwise required by Division 1.
- F. Warranties: Submit copies of all manufacturers' warranties.
- G. Record Drawings: Submit record drawings.
- H. Acceptance will be made on the basis of tests and inspections of the work. A representative of the firm that performed test and balance work shall be in attendance to assist. The contractor shall furnish necessary mechanics to operate system, make any necessary adjustments and assist with final inspection.

**This is a sample cover
sheet. Use one for
each shop drawing.**

ARCHITECT/ENGINEER: W3 Engineering LLC

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Mechanical Contractor

SUPPLIER: Supply Company

MANUFACTURER: Manufacturer

DATE: MM/DD/YYYY

SECTION: 23 XX XX / Section Name

PROJECT NAME
PROJECT NUMBER

Any standard
heading is
acceptable

SAMPLE

1. Description: Manufacturer, Model
2. Description: Manufacturer, Model
3. Description: Manufacturer, Model
4. Description: Manufacturer, Model
5. Description: Manufacturer, Model

**List each item
separately;
include
manufacturer name
and model number.**

END OF SECTION

**Contractor's
APPROVAL stamp
must be on this
sheet.**

SECTION 23 00 10 - CODES AND STANDARDS

PART 1 - GENERAL

- 1.1 All work under Division 23 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, the Contractor shall be responsible for calling to the Architect/Engineer's attention any details on the drawings or specifications that are not in conformance with these or other codes and standards.
- 1.2 Comply with regulations and codes of utility suppliers.
- 1.3 Where no specific method or form of construction is called for in the contract documents, the Contractor shall comply with code requirements when carrying out such work.
- 1.4 Where code conflict exists, the most stringent requirement applies. Comply with current code edition, unless noted.

PART 2 - CODES

- 2.1 The following codes shall govern all work:
 1. Florida Building Code – Eighth Edition (2023) – Building
 2. Florida Building Code – Eighth Edition (2023) – Existing Building
 3. Florida Building Code – Eighth Edition (2023) – Energy Conservation
 4. Florida Building Code – Eighth Edition (2023) – Mechanical
 5. Florida Building Code – Eighth Edition (2023) – Plumbing
 6. Florida Building Code – Eighth Edition (2023) – Fuel Gas
 7. Florida Building Code – Eighth Edition (2023) – Accessibility
 8. National Electric Code (NFPA 70) – 2014
 9. Fire Alarm and Signaling Code (NFPA 72) – 2013
 10. Standard for Air Conditioning and Ventilating Systems (NFPA 90A) – 2015
 11. Standard for Commercial Cooking Operations (NFPA 96) – 2014
 12. Health Care Facilities Code (NFPA 99) – 2021
 13. FGI Guidelines for Design and Construction of Hospitals and Outpatient Facilities – 2022
 14. Florida Fire Prevention Code Fifth Edition
 - a. Fire Code (NFPA 1) – 2021
 - b. Life Safety Code (NFPA 101) – 2021

PART 3 - STANDARDS

- 3.1 All mechanical materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments, to the extent referenced:
 1. Underwriters' Laboratories (UL)
 2. American National Standards Institute (ANSI)
 3. American Society of Testing Materials (ASTM)
 4. National Fire Protection Association (NFPA)
 5. National Electrical Manufacturers Association (NEMA)
 6. Air Conditioning, Heating, and Refrigeration Institute (AHRI)
 7. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 8. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
 9. Air Movement and Control Association (AMCA)

END OF SECTION

SECTION 23 00 20 - HVAC RELATED WORK

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. This is a Common Work Results for HVAC section. Provisions of this section apply to work of all Division 23 sections.
- C. Coordinate with the General Contractor for all cutting and patching. Contractors performing Division 23 work shall inform the General Contractor of all cutting and patching required prior to bidding and shall coordinate installation.

PART 2 - DIVISION 2 – SITE WORK

- 2.1 Specific requirements for excavation and backfill for underground piping are contained in Section 23 05 50.
- 2.2 Refer to Division 2 – Site Work for:
 - A. Manholes and catch-basins.
 - B. Underground tanks and enclosures.
- 2.3 The following work is part of Division 23:
 - A. All site piping within five feet of building footprint.
 - B. Underground tanks and enclosures within five feet of building footprint.

PART 3 - DIVISION 3 – CONCRETE

- 3.1 Refer to Division 3 – Concrete for:
 - A. Rough grouting in and around mechanical work.
 - B. Cutting and patching concrete to accommodate mechanical work.
- 3.2 The following work is part of Division 23, complying with the requirements of Division 3:
 - A. Curbs, foundations and pads for mechanical equipment.
 - B. Basins, sumps, and vaults for mechanical work.
 - C. Underground structural concrete to accommodate mechanical work.
 - D. Inertia bases.

PART 4 - DIVISION 4 – MASONRY

- 4.1 Refer to Division 4 – Masonry for:
 - A. Installation of wall louvers.
 - B. Installation of access doors in walls.

PART 5 - DIVISION 5 – METALS

- 5.1 Refer to Division 5 – Metals for:
 - A. Framing openings for mechanical equipment.
- 5.2 The following work is part of Division 23:
 - A. Supports for mechanical work.

PART 6 - DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

- 6.1 Refer to Division 6 – Wood, Plastics, and Composites for:
 - A. Framing openings for mechanical equipment.

PART 7 - DIVISION 7 – THERMAL AND MOISTURE PROTECTION

- 7.1 Refer to Division 7 – Thermal and Moisture Protection for:
 - A. Installation of all roof curbs and roof supports for mechanical work.
 - B. Caulking and waterproofing of all wall- and roof-mounted mechanical work.
 - C. Flashing of all roof curbs and roof vents.
- 7.2 The following work is part of Division 23, complying with the requirements of Division 7:
 - A. Fire barrier penetration seals.

PART 8 - DIVISION 8 – OPENINGS

- 8.1 Refer to Division 8 – Openings for:
 - A. Installation of all door grilles.
 - B. Providing all door undercuts.

PART 9 - DIVISION 9 – FINISHES

9.1 Refer to Division 9 – Finishes for:

- A. Painting exposed ductwork, piping, and equipment.
- B. Painting structural metal and concrete for mechanical work.
- C. Painting door grilles and access panels.
- D. Painting color-coded mechanical work indicated for continuous painting. See color schedule in Division 23 Section, "HVAC Identification".
- E. Installation of access doors in gypsum drywall.

9.2 Colors shall be selected by the Architect for all paintings of exposed mechanical work in occupied spaces, unless specified herein. Do not paint insulated or jacketed surfaces.

9.3 The following work is part of Division 23:

- A. Touch-up painting of factory finishes.
- B. Painting of all hangers.

PART 10 - DIVISION 10 – THERMAL SPECIALTIES

10.1 Refer to Division 10 – Specialties for:

- A. Fire extinguishers and fire extinguisher cabinets and accessories.

PART 11 - DIVISION 11 – EQUIPMENT

11.1 The following work is part of Division 23:

- A. All ductwork, fans, related devices, and final connections necessary to make fume hoods, canopy hoods, and snorkel exhaust systems operational.
- B. All trim not furnished by Division 11 including drains, waste, traps, and similar devices necessary to make fixtures operational. Provide rough-in for all fixtures. Provide final connections for all fixtures.

PART 12 - DIVISION 26 – ELECTRICAL

12.1 Mechanical contractors shall coordinate the exact electrical requirements of all mechanical equipment being provided with the electrical contractor. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The electrical design shown on the drawings supports the mechanical equipment basis 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 design 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.

12.2 Mechanical contractors shall provide all HVAC control wiring including the Energy Management Control System sensors, alarms, and input/output signals and all relays, interlocks, warning lights, and control devices, complying with the requirements of Division 26. The intent is for the mechanical contractor to be responsible for the entire HVAC control system, including point-to-point wiring.

12.3 Electrical contractors shall provide disconnect switches, starters, and contactors for mechanical equipment unless specifically noted as being furnished as part of the mechanical equipment.

12.4 Electrical contractors shall provide all power wiring, raceway and devices, and make final electrical connections to all mechanical equipment, switches, starters, contactors, controllers, and similar equipment.

12.5 All duct-mounted smoke detectors shall be furnished and wired by the electrical contractor and installed by the mechanical contractor.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. This section is a Division 23 Common Work Results for HVAC section and is part of each Division 23 section making reference to or requiring hangers and supports specified herein.
- C. Extent of hangers and supports required by this section is indicated on drawings and/or specified in other Division 23 sections.

1.2 Codes and Standards:

- A. Code Compliance: Comply with applicable codes pertaining to product materials and installation of hangers and supports.
- B. MSS Standard Compliance:
 - 1. Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.
 - 2. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - 3. Terminology used in this section is defined in MSS SP-90.
- C. UL Compliance: Provide products which are UL listed.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide supports and hangers by Grinnell, 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.

- A. Adjustable Steel Clevises: MSS Type 1.
- B. Steel Double Bolt Pipe Clamps: MSS Type 3.
- C. Adjustable Steel Band Hangers: MSS Type 7.
- D. Steel Pipe Clamps: MSS Type 4.
- E. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.
- F. Single Pipe Rolls: MSS Type 41.
- G. Adjustable Roller Hanger: MSS Type 43.
- H. 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.

- A. Two-Bolt Riser Clamps: MSS Type 8.
- B. 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.

- A. Steel Turnbuckles: MSS Type 13.
- B. 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.
 - A. Center Beam Clamps: MSS Type 21.
 - B. C-Clamps: MSS Type 23.
 - C. Malleable Beam Clamps: MSS Type 30.
 - D. Side Beam Brackets: MSS Type 34.
 - E. 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.
 - A. Protection Shields: MSS Type 40, of length recommended by manufacturer to prevent crushing of insulation.
 - B. Protection Saddles: MSS Type 39, use with rollers; fill interior voids with segments of insulation matching adjoining insulation.
- 2.7 Roof Curbs: Furnish 12-inch high, roofed over type, pre-fabricated aluminum curbs with treated wood nailer and 1-1/2" fire resistant fiberglass insulation sized to match pipe or duct. For deck slopes of 1/4" per foot and more, fabricate curbs to form level top edge. Provide sloped, welded stainless steel cap where duct or pipe passes through.
- 2.8 Miscellaneous Materials:
 - A. Metal Framing: Provide products complying with NEMA STD ML 1.
 - B. Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.
 - C. 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.
 - D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes or continuous channel struts selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

- 3.1 Preparation:
 - A. Proceed with installation of hangers and supports 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.
 - B. Prior to installation of hangers, supports, 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:
 - A. 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.
 - B. 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:

- A. 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 spacing 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.
 - 1. Horizontal steel pipe and copper tube 1-1/2" diameter and smaller: support on 6-foot centers.
 - 2. Horizontal steel pipe and copper tube over 1-1/2" diameter: support on 10-foot centers.
 - 3. Plastic pipe: support in accordance with manufacturer's recommendations.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
- C. Paint all black steel hangers with black enamel. Galvanized steel and copper clad hangers do not require paint.
- D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- E. Provision for Movement:
 - 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.
 - 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. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.
- F. Insulated Piping: Comply with the following installation requirements:
 - 1. Shields: Where low-compressive-strength insulation or vapor barriers are indicated, install coated protective shields.
 - 2. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

3.4 Installation of Anchors:

- A. 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.
- B. Fabricate and install anchors by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Anchor Spacing: 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.
- D. 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:

- A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 23. Size bases to extend minimum of 6" beyond equipment base in any direction, and 4" above finished floor elevation (6" above finished floor elevation for boilers). 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.

- B. 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.

3.6 Roof Curbs: Furnish roof curbs to roofing Installer for installation.

END OF SECTION

SECTION 23 05 53 - HVAC IDENTIFICATION

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. This section is a Division 23 Common Work Results for HVAC section and is part of each Division 23 section making reference to or requiring identification devices specified herein.
- C. Extent of HVAC identification work required by this section is indicated on drawings and/or specified in other Division 23 sections.
- D. 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 HVAC controls (not work of this section).

1.2 Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 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 a single type is specified for application, selection is the Contractor's option, but provide single selection for each product category.

2.2 Painted Identification Materials:

- A. 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 1-1/4" high letters for ductwork and not less than 3/4" high letters for access door signs and similar operational instructions.
- B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
- C. Identification Paint: Standard identification enamel.

2.3 Plastic Pipe Markers:

- A. 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.
- B. 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:

- A. Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and 1/2" high sequenced valve numbers, and with 5/32" hole for fastener. Provide 1-1/2" diameter tags, except as otherwise indicated.
- B. 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 1/2" high sequenced valve numbers, 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:

- A. 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.
- B. Thickness: 1/16" for units up to 20 square inches or 8" length; 1/8" for larger units.
- C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.6 Stamped Nameplates: Provide equipment manufacturer's standard stamped nameplates for

motors, AHUs, pumps, etc.

PART 3 - EXECUTION

- 3.1 Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- 3.2 Ductwork Identification:
- A. 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.
 - B. 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' spacing along exposed runs.
 - C. 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:
- A. 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:
 - 1. Plastic pipe markers.
 - 2. Stenciled markers of black or white for best contrast.
 - B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.
 - 1. Near each valve and control device.
 - 2. Near each branch, excluding short take-offs for equipment and terminal units. Mark each pipe at branch where there could be question of flow pattern.
 - 3. Near locations where pipes pass through walls or floors/ ceilings or enter non-accessible enclosures.
 - 4. At access doors, manholes, and similar access points which permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
 - 7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- 3.4 Mechanical Equipment Identification:
- A. General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device. Label shall indicate type of system and area served. Provide signs for the following general categories of equipment and operational devices:
 - 1. Main control and operating valves, including safety devices.
 - 2. Meters, gauges, thermometers, and similar units.
 - 3. Fans, blowers, primary balancing dampers.
- 3.5 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all major equipment items such as motors, pumps, boilers, chillers, 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.
- 3.6 Adjusting and Cleaning:

- A. Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

- 1.1 The Contractor shall install all specified gauges, balancing valves, dampers, and other work required by the Contract Documents. The Contractor shall change all dirty filters where directed by the TAB contractor.
- 1.2 The Contractor shall include an allowance to cover costs of the A/E's TAB contract as indicated in the Division 01 specifications.
- 1.3 Scope of Work: Extent of testing, adjusting, and balancing work (TAB) is indicated by the requirements of this section, and also by drawings and schedules. TAB 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.
- 1.4 References to Other Sections: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section. Division 23 Common Work Results for HVAC sections apply to work of this section.
- 1.5 Coordination: Coordinate with the General Contractor and Mechanical Contractor responsible for the HVAC system installation as required to complete the TAB work.
- 1.6 Description of Work:
 - A. Components to be tested, adjusted, and balanced specified in this section shall include the following as applied to mechanical equipment:
 1. Fans
 2. Ductwork systems
 3. Coils
 - 1.7 Tolerances: The intent of this specification to balance HVAC systems within the tolerances listed, maintaining the pressure relationships indicated, with a minimum of noise.
 - A. Airflow Tolerances:
 1. Exhaust Fans: Exhaust fan quantities shall be set as required to maintain the design exhaust terminal flows within $\pm 5\%$ of design values. If no exhaust terminals exist, exhaust fan air quantities shall be balanced within $\pm 10\%$ of design values.
 2. Ceiling Diffusers, Supply Registers, Return and Exhaust Inlets: Air quantities shall be balanced within $\pm 10\%$ of design values.
 - B. Temperature Tolerances:
 1. Room Temperatures: Balance systems and controls within $\pm 2^\circ\text{F}$ of indicated settings.
 - 1.8 Quality Assurance:
 - A. The TAB contractor shall meet one of the following:
 1. A firm certified by National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project, which is not the installer of the system to be tested and is otherwise independent of project. Comply with NEBB's "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems" as applicable to this work.
 2. A firm certified by the 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.
 - B. 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.

1.9 Job Conditions:

- A. Do not proceed with testing, adjusting, and balancing work until HVAC work (including controls) has been completed and system is operable. Ensure that there is no residual work still to be completed.
- B. Do not proceed until system scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.
- C. Do not proceed until architectural work that would affect balancing (walls, ceiling, windows, doors, etc.) has been completed.
- D. Testing may proceed system by system, but each HVAC system must be completed as described herein.
- E. The mechanical contractor shall make any changes to fan speeds and dampers, and/or add dampers as required for correct balancing.

1.10 Approval Submittals:

- A. Submit the name of the proposed test and balance company for the Engineer's approval within thirty (30) days after awarding of contract.
- B. Submit 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.

PART 2 - PRODUCTS

2.1 Patching Materials: Except as otherwise indicated, use the same products as used by the 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 twelve (12) months, or more recently if required by standard.

PART 3 - EXECUTION

3.1 General:

- A. 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 a manner acceptable to the tester.
- B. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards, and as modified or detailed herein.
- C. Test, adjust and balance system during summer season for air conditioning systems and during winter season for heating systems, including at least a period of operation during 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, 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.
- D. Punch List: Prepare a deficiency (punch) list for the Contractor with a copy to the Engineer that lists all items that are incorrectly installed or are functioning improperly. Provide a retest after all items are corrected.
- E. Prepare TAB Report of test results, including instrumentation calibration reports, in the format recommended by applicable standards, modified as required to include all data listed herein.
- F. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.
- G. 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.

- H. Include in the TAB Report recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.
- I. Include an extended warranty of ninety (90) days after completion of testing, adjusting, and balancing work, during which time the Engineer, at his discretion, may request a recheck, or resetting of any component as listed in test report. TAB contractor shall provide technicians and instruments and make any tests required by the Engineer during this time period.

3.2 Controls:

- A. Check all temperature and humidity controllers for location and calibration.
- B. Check operation of all controllers and controlled devices to verify proper action and connection. Check operation of all interlocks.
- C. Check all motorized damper motors for leakage when in closed position. If leakage is more than 5%, the mechanical contractor shall reset damper linkages.

3.3 Air Balancing:

- A. Leakage tests on ductwork must have been completed before air balancing can begin.
- B. 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.
- C. Set grille deflections as noted on drawings. Modify deflections if required to eliminate drafts or objectionable air movement.
- D. Record air terminal velocity after completion of balance work.
- E. Record final grille and register deflection settings if different from that specified on Contract Drawings.
- F. Record all fan speeds.

3.4 Data Collection:

- A. 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.
- B. It is the intent of this section to record data on balanced systems, under normal operating or design conditions.
- C. 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.
- D. Pressures:
 - 1. Suction and discharge static pressure of each fan.
- E. Flow rates:
 - 1. Air flow rate through each fan.
- F. Nameplate Data:
 - 1. Complete nameplate data for all other 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.

END OF SECTION

SECTION 23 31 13 - METAL DUCTWORK

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. Division 23 Common Work Results for HVAC sections apply to work of this section.
- C. Extent of HVAC metal ductwork is indicated by drawings and schedules, and by requirements of this section.
- D. Refer to other Division 23 sections for exterior insulation of metal ductwork.
- E. Refer to other Division 23 sections for ductwork accessories.

1.2 Codes and Standards:

- A. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" 2020 Edition for fabrication and installation of metal ductwork, unless otherwise noted.
- B. NFPA 90A Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 Approval Submittals:

- A. Product Data: Submit manufacturer's technical product data and installation instructions for the following:
 - 1. Factory-fabricated ductwork
 - 2. Sealants
- B. 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.

PART 2 - PRODUCTS

2.1 Ductwork Materials:

- A. 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.
- B. Galvanized Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A527, lockforming quality, with G90 zinc coating in accordance with ASTM A525, 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:

- A. 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.
- B. 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.
- C. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
 - 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, Florida Energy Conservation Code, SBCC, NFPA 90A and NFPA 90B.

2. Acceptable Manufacturers: Subject to compliance with requirements, provide R-6 flexible ductwork by: Atco 36, Flexmaster 6M-R6 or Thermaflex M-KE R6.
- D. 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:
 - A. 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.
 - B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA "HVAC Duct Construction Standards", except provide sealant at all joints. All return and exhaust duct shall be minimum 2" pressure class unless otherwise noted.
 - C. 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 1-1/2 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.
 - D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Ductwork Accessories" for accessory requirements.
- 2.4 Factory-Fabricated Low Pressure Ductwork (Maximum 2" W.G.):
 - A. Material: Galvanized sheet steel complying with ASTM A527, lockforming quality, with ASTM A525, G90 zinc coating, mill phosphatized.
 - B. Gauge: 28-gauge minimum for round ducts and fittings, 4" through 14" diameter, unless penetrating fire-rated assemblies (26-gauge minimum). 26-gauge minimum 16" through 18", 24-gauge minimum 20" through 24".
 - C. Elbows: One piece construction for 90° and 45° elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.
 - D. Divided Flow Fittings: 90° tees, constructed with saddle tap spot welded and bonded to duct fitting body.
 - E. Acceptable Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork by Semco Mfg., Inc., United Sheet Metal Div., United McGill Corp, or approved equal.

PART 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 a manner acceptable to Installer.
- 3.2 Installation of Metal Ductwork:
 - A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" w.g. and under) 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.
 - B. 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.
- C. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements. Seal joints in round ductwork with hard cast or shrink bands, and sheet metal screws, or by welding.
 - D. 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 1/2" 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.
 - E. Electrical Equipment Spaces: Do not route ductwork through transformer vaults or other electrical equipment spaces and enclosures.
 - F. 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 1-1/2". Fasten to duct and substrate. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate.
 - G. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
 - H. 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:
- A. Maximum Length: For any duct run using flexible ductwork, do not exceed 8'-0" extended length. Flexible duct shall only be allowed as detailed on the drawings.
 - B. 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.
 - C. 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.
 - D. Seal all exposed edges of fiberglass insulation with glassfab and mastic or insulation tape.
- 3.4 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.
- 3.5 Clean ductwork internally until 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.
- 3.6 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.
- 3.7 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

SECTION 23 33 00 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. Division 23 Common Work Results for HVAC sections apply to the work of this section.
- C. Extent of ductwork accessories work is indicated by drawings and schedules, and by requirements of this section.
- D. Refer to other Division 23 sections for testing, adjusting, and balancing of ductwork accessories (not work of this section).

1.2 Codes and Standards:

- A. SMACNA Compliance: Comply with applicable portions of both SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

1.3 Approval Submittals:

- A. Product Data: Submit manufacturer's technical product data each type of ductwork accessory, including dimensions, capacities, materials of construction, and installation instructions for the following:

- 1. Spin-in fittings
- 2. Side takeoff fittings
- 3. Low pressure manual dampers
- 4. Duct access doors
- 5. Flexible connections

- 1.4 O&M Data Submittals: Submit manufacturer's maintenance data including parts lists. Include this data, product data, and a copy of approval submittals in O&M Manual.

PART 2 - PRODUCTS

- 2.1 Duct Spin-in and Side Takeoff Fittings: Provide round branch duct run-outs as follows.

- A. Exhaust air grille connections shall be straight-sided with damper equal to Crown 724 or Flexmaster FLD.

2.2 Dampers:

- A. Low Pressure Manual Dampers: Provide 16 gauge dampers of single-blade type (12" maximum blade width) or multi-blade 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.

- B. Acceptable Manufacturers: Subject to compliance with requirements, provide dampers by Arrow Louver and Damper, Greenheck, Penn Ventilator Co., Pottorff, Ruskin Mfg. Co., or TAMCO.

- 2.3 Turning Vanes: Provide manufactured or fabricated single wall turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

2.4 Duct Access Doors:

- A. General: Provide duct access doors of sizes indicated, or as required for duty indicated.
- B. 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, two handle-type latches for larger doors.
- C. Acceptable Manufacturers: Subject to compliance with requirements, provide access doors by Ductmate, Duro Dyne Corp., Greenheck, Pottorff, or Ruskin Mfg. Co.

2.5 Flexible Connections:

- A. 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.

- B. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following: Duro Dyne Corp., Flexaust (The) Co., or Ventfabrics, Inc.

PART 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:
- A. 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.
 - B. Install balancing dampers at all main ducts adjacent to units in return air, outside air, and where indicated.
 - C. Install turning vanes in square or rectangular 90° elbows in supply, return, and exhaust air systems, and elsewhere as indicated.
 - D. 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.
 - E. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.
- 3.3 Adjusting and Cleaning:
- A. Adjust ductwork accessories for proper settings.
 - B. 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.
 - C. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 23 34 00 - FANS

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. Division 23 Common Work Results for HVAC sections apply to work of this section.
- C. Extent of fan work required by this section is indicated by drawings and schedules, and requirements of this section.
- D. Refer to Division 23 section "Testing, Adjusting, and Balancing" for balancing of fans.
- E. Refer to Division 23 HVAC control systems sections for control work required in conjunction with fans.
- F. Refer to Division 26 sections for power supply wiring from power source to power connection on fans. Division 26 work includes starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1.2 Codes and Standards: In addition to the codes and standards listed in Section 23 00 10, comply with the following:

- A. AMCA Compliance: Provide fans which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Ratings Seal.
- B. UL Compliance: Provide fans which are listed by UL and have UL label affixed.

1.3 Approval Submittals:

- A. Product Data:.

1. Fans

1.4 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.

PART 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 Accurex, Acme, Greenheck, Loren Cook, MK Plastics, PennBarry, Strobic Air, Twin City, or approved equal unless otherwise noted herein.

2.3 Centrifugal Roof Exhaust Fans:

- A. Housing: Provide heavy gauge aluminum hood, housing, and base with a galvanized steel frame.
- B. Fan Wheels: Provide aluminum airfoil type, statically and dynamically balanced.
- C. 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.
- D. Isolation and Support: Provide spring type vibration isolators and fan support brackets.

2.4 Centrifugal Ceiling Exhaust Fans:

- A. Fan Assembly: Provide steel housing, plastic or aluminum grille, backdraft damper, statically and dynamically balanced fan wheel, permanently lubricated motor with internal thermal overloads, vibration isolation, and all required mounting hardware and brackets. Provide acoustically-treated housing for all fans larger than 60 cfm. Mounting type shall be as indicated on the drawings or on the schedule.
- B. Connectors: Provide adaptors, connectors, and eave elbows as required to connect fan discharges to outlets.
- C. Outlets: Provide where shown on the drawings (or required by the installation) wall caps, vent caps, or roof jacks, each with birdscreen, to match fans and surrounding construction.

2.5 Inline Centrifugal Fans:

- A. Housing: Provide round aluminum or square weather tight housing constructed of steel and painted inside and out with an epoxy finish. Provide venturi type inlet.
- B. Fan Wheels: Provide aluminum airfoil type, backward curved, statically and dynamically balanced.
- C. 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.
- D. Isolation and Support: Provide spring type vibration isolators and fan support brackets.
- E. Fan Wheel: Provide aluminum, non-sparking air foil type, statically and dynamically balanced.

2.6 Fan Accessories and Features: Where indicated on the schedule or drawings, provide accessories and features listed herein.

- A. Belt Drive: Belt drives shall include cast iron, variable pitch sheaves, heavy duty belts, and 1750 rpm motors. The drive shall be adjustable to plus or minus 20% of scheduled flow. Provide fixed sheaves after balancing is complete.
- B. Belt Tensioner: Provide factory-installed automatic belt tensioner to maintain proper belt tension.
- C. Direct Drive: Direct drives shall have multispeed motors or speed controllers to achieve scheduled flow.
- D. Curbs: Furnish minimum 12-inch high, roofed over type, prefabricated aluminum curbs with treated wood nailer and 1-1/2" fire resistant fiberglass insulation sized to match the fans. Coordinate curb height with architectural drawings such that curbs extend a minimum of 8 inches above the roof surface. For deck slopes of 1/4" per foot and more, fabricate curbs to form level top edge.
- E. Bird Screens: Provide bird screens of 1/2" mesh aluminum or galvanized steel hardware cloth.
- F. Backdraft Dampers: Where indicated, provide aluminum louvered dampers with felt-edged blades and nylon bearings.
- G. Disconnect Switches: Provide factory installed local disconnecting means.
- H. Thermal Overloads: Provide internal thermal overloads.
- I. Speed Controller: Where indicated, provide speed controller.
- J. Motorized Dampers: Where indicated, provide aluminum louvered dampers with felt-edged blades and nylon bearings with 120 volt motors wired to operate with the fan. Provide limit switch to prevent fan starting until damper is at least half open.
- K. Vibration Isolation: Mount fans on vibration isolators in accordance with the requirements of Division 23 Section "Vibration Isolation".

PART 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 ensure 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 "Metal 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 Roof Curbs: Furnish roof curbs to roofing Installer for installation.
- 3.6 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 startup until wiring installation is acceptable to equipment installer.

- 3.7 Remove shipping bolts and temporary supports within fans. Adjust dampers for free operation.
- 3.8 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, and then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.
- 3.9 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

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. Division 23 Common Work Results for HVAC sections apply to the work of this section.
- C. Extent of diffusers, registers, and grilles work is indicated by drawings and schedules, and by requirements of this section.
- D. Refer to other Division 23 sections for ductwork and duct accessories required in conjunction with diffusers, registers, and grilles and for air balancing.

1.2 Codes and Standards:

- A. ADC Compliance: Test and rate diffusers, registers, and grilles in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual". Provide diffusers, registers, and grilles bearing ADC Certified Rating Seal.
- B. NFPA Compliance: Install diffusers, registers, and grilles in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 Approval Submittals:

- A. Product Data: Submit manufacturer's technical product data for diffusers, registers, and grilles indicating construction, finish, and mounting details.
- B. Performance Data: For each type of diffuser, register, and grille furnished, provide aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections and data as required.

1.4 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.

PART 2 - PRODUCTS

2.1 General:

- A. Except as otherwise indicated, provide manufacturer's standard diffusers, registers, and grilles where shown, of size, shape, capacity and type indicated. Construct of materials and components as indicated, and as required for complete installation.
- B. Manufacturers not listed in the following specification will not be considered for approval unless accepted by addendum prior to bid.
- C. Performance: Provide diffusers, registers, and grilles 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.
- D. Ceiling and Wall Compatibility: Provide diffusers, registers, and grilles 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 diffuser, grille, or register.
- E. Appearance: All grilles and registers shall be aluminum construction and all diffusers shall be 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.
- F. Finish: All ceiling-mounted diffusers, registers, and grilles shall be finished with baked white enamel. Wall- and door-mounted grilles and registers shall be finished with baked white enamel.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products by Titus, Price, or Greenheck.

2.3 Diffusers, Registers, and Grilles:

- A. Square Ceiling Diffusers (CD-1): Provide square face, adjustable, 360° pattern diffusers with one-piece stamped cones, no corner joints, round necks. Provide lay-in panel as required.

Provide trim ring for diffusers in hard ceilings to allow opening to be used for access. Diffusers with 24"x24" face: Titus TMSA-AA. Diffusers with 12"x12" face: Titus TMS-AA.

- B. Square Ceiling Diffusers (CD-1): Provide square face, 360° pattern plaque diffusers with round necks. Provide lay-in panel as required. Provide trim ring for diffusers in hard ceilings to allow opening to be used for access. Diffusers with 24"x24" face: Titus OMNI-AA. Diffusers with 12"x12" face: Titus OMNI-AA.
- C. Perforated Ceiling Diffusers (CD-2): Provide 24"x24" square face, adjustable pattern, perforated face diffusers. If square neck diffusers are submitted, provide square-to-round adaptors as required. Provide trim ring for diffusers in hard ceilings to allow opening to be used for access. Titus PAS-A.
- D. Rectangular Ceiling Diffusers (CD-4): Provide rectangular face, adjustable diffuser with removable inner core, no corner joints. If square or rectangular neck is provided, provide square-to-round adaptor as required. Provide lay-in panel as required. Provide trim ring for diffusers in hard ceilings to allow opening to be used for access. Titus TDCA-AA.
- E. Return Grilles (RG-1): Provide return grilles with one set of 45° fixed louvers, parallel to the long dimension. Provide mounting frame for all wall and plaster ceiling installations. Titus 350 FL.
- F. Return Registers (RR-1): Provide return registers with one set of 45° fixed louvers, parallel to the long dimension. Provide opposed blade damper, screwdriver operated from the face. Provide mounting frame for all wall and plaster ceiling installations. Titus 350 FL.
- G. Exhaust Grilles (EG-1): Provide exhaust grilles with one set of 45° fixed louvers, parallel to the long dimension. Provide mounting frame for all wall and plaster ceiling installations. Titus 4FL.
- H. Transfer Grilles (TG): Provide transfer grilles with one set of 45° fixed louvers, parallel to the long dimension. Titus 4FL.
- I. Filter Return Grilles (FRG): Provide filter return grilles with one set of 45°, fixed louvers, parallel to the long dimension. Provide frame and hinged core with provision for onetwo-inch thick filters. Titus 4FL.
- J. Door Grilles (DG): Provide aluminum door grilles with vee core, fixed louvers, spaced 1/2", flanged frame, and telescoping auxiliary flanged frame. Provide a prime coat ready for field painting. Titus T-700.

PART 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 diffusers, registers, and grilles in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended functions.
- 3.3 All items visible through return air grilles shall be painted flat black.
- 3.4 Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of diffusers, registers, and grilles with other work.
- 3.5 Set air volumes to values shown on the drawings so that the system is functional. Leave ready for Test and Balance Contractor.
- 3.6 Furnish to Owner three operating keys for each type of diffuser, register, and grille that require them; obtain receipt.

END OF SECTION

SECTION 23 82 39 - ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. Division 23 Common Work Results for HVAC sections apply to work of this section.
- C. Refer to Division 26 sections for power supply wiring from power source to power connection on equipment. Division 26 work will include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer, and interlock wiring between equipment and field-installed control devices.

1.2 Codes and Standards:

- A. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to construction and installation of electric heaters.
- B. UL Compliance: Comply with applicable requirements of UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors". Provide electric heaters which are UL-listed and labeled.
- C. NEMA Compliance: Provide electric heater accessories which comply with NEMA standards.

1.3 Approval Submittals:

- A. Product Data: Submit manufacturer's product data and installation instructions for electric heaters showing dimensions, weights, capacities, and electrical characteristics. Submit wiring diagrams showing connections to electrical power feeders, and associated control wiring. Clearly differentiate between wiring which is manufacturer-installed and that which is field-installed.

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts list. Include in O&M Manual.

PART 2 - PRODUCTS

2.1 Electric Propeller Unit Heaters:

- A. General: Except as otherwise indicated, provide manufacturer's standard electric propeller unit heater materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for a complete installation.
- B. Heating Elements: Except as otherwise indicated, provide manufacturer's standard heating elements of types, sizes, capacities and ratings for duty indicated, consisting of resistance elements in steel sheath with extended fins, or with spirally finned sheath.
- C. Heating Capacity: Size element for indicated fan speed, cfm, room heating load (BTUH), entering air temperature, and electric inputs (watts, voltage, phase).
- D. Casings: Provide casings braced and reinforced to provide required stiffness, and with adjustable heating element supports and brackets. Phosphatize and paint casings inside and out with single coat of baked-on enamel; and zinc plate hardware. Include fan orifice (venturi) in casing, as well as threaded hanger connections (weld nuts). Fabricate from 18-gauge galvanized steel.
- E. Air Deflectors: Provide manufacturer's standard air deflectors of the following types:

1. Horizontal Discharge

- a. 2-way horizontal louvers
- b. 4-way finned louvers

2. Vertical Discharge

- a. Cone diffusers

- b. Vane outlets
 - c. Louver outlets
 - d. Anemostat diffusers
 - e. Revolving diffusers
 - F. Motors: Provide totally enclosed shaded-pole or permanent-split capacitor motors, Class "B" insulation, resiliently mounted, tap wound with built-in thermal overload protection, and with sleeve type or permanently lubricated ball bearings. Select motors with the following rating: 120-volts, 60 Hz, single-phase.
 - G. Motor Controls: Provide remote wall-mounted, multi-speed motor control switch with "OFF" position.
 - H. Internal Electrical Wiring: Provide units with high temperature, heat-resistant electrical wiring enclosed in flexible metal conduit extending from terminal junction box to electrical devices. Provide fusing for motor and control circuit wiring.
 - I. Provide propeller unit heaters with the following devices:
 - 1. Thermally activated fan switch to keep fan motor operating until residual heat is dissipated.
 - 2. Fused disconnect switch.
 - 3. Automatic reset, high limit cut-out switch located in discharge air stream.
 - 4. Magnetic contactor.
 - 5. Transformer.
 - 6. Wall-mounted thermostat.
 - J. Fans: Provide aluminum propeller fans which are balanced statically and dynamically, of indicated capacity.
 - K. Acceptable Manufacturers: Chromalox, Modine, QMark, Trane, or approved equal.
- 2.2 Electric Pump House Heaters:
- A. General: Except as otherwise indicated, provide manufacturer's standard electric pump house heater materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for a complete installation.
 - B. Heating Elements: Except as otherwise indicated, provide manufacturer's standard heating elements of types, sizes, capacities and ratings for duty indicated, consisting of resistance elements in steel sheath with extended fins, or with spirally finned sheath.
 - C. Heating Capacity: Size element for indicated room heating load (BTUH) and electric inputs (watts, voltage, phase).
 - D. Casings: Provide casings braced and reinforced to provide required stiffness, and with adjustable heating element supports and brackets. Phosphatize and paint casings inside and out with a single coat of baked-on enamel, and zinc plate hardware. Fabricate from minimum 24-gauge galvanized steel.
 - E. Controls: The heater housing shall contain an enclosed tamperproof control box to isolate all live electrical parts from the remainder of the heater. An integral thermostat with a temperature range of 40°F to 70°F shall be completely contained in the control box.
 - F. Electrical Wiring: The heater shall be rated to operate at 120, 208, or 240 VAC.
 - G. Acceptable Manufacturers: Dayton, Modine, QMark, Trane, or approved equal.
- 2.3 Fan-Forced Ceiling Heaters:
- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling-mounted, forced air electric heaters as indicated on the drawings, designed and constructed as recommended by manufacturer, and as required for a complete installation.
 - B. Heating Elements: Except as otherwise indicated, provide manufacturer's standard heating elements of types, sizes, capacities and ratings for duty indicated, consisting of resistance elements in steel sheath with extended fins, or with spirally finned sheath.
 - C. Heating Capacity: Size element for indicated room heating load (BTUH) and electric inputs

(watts, voltage, phase).

- D. Casings: Provide recessed type heaters and mounted flush with the finished ceiling. The return grille assembly shall be constructed of one-piece heavy gauge steel with 1/4" slots for return air and center outlet for uniform air discharge. Grille assembly shall be attached to the chassis by tamper-resistant (allen head) machine screws. All parts of the enclosure shall be heavy gauge steel, zinc-coated both sides and finished in neutral off-white power coat paint.
- E. Motors: Provide permanently lubricated, unit bearing, totally enclosed motors with impedance protection. Motors shall operate at no more than 1300 rpm and shall have same voltage as the heater.
- F. Controls and Accessories: Provide disconnect switch and thermostat. Provide manual reset thermal overload for protection against excessive operating temperatures.
- G. Acceptable Manufacturers: Chromalox, Modine, QMark, or approved equal.
- 2.4 Vibration Isolation: Provide vibration isolation products complying with Division 23 section "Vibration Isolation" and the following:
 - A. Hangers: Type HA1, HA2, HA3 as applicable.

PART 3 - EXECUTION

- 3.1 Examine areas and conditions under which electric heaters are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- 3.2 Hang units from substrate using threaded rods and building attachments. Secure rods to unit hanger attachments. Install vibration isolation equipment. Adjust hangers so unit is plumb and level.
- 3.3 Coordinate mounting heights with general construction. In areas where continuous lengths are not required, center units on the predominate architectural feature (wall, column, etc.) unless architectural drawings show otherwise.
- 3.4 Install electric heaters including components as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, complying with applicable installation requirements of NEC and NECA's "Standard of Installation".
- 3.5 Coordinate with electrical work, including wiring/cabling, as necessary to properly interface installation of heating units with other work.
- 3.6 Clean dust and debris from each heater as it is installed to ensure cleanliness. Comb out damaged fins before installing enclosures. Touch-up any scratched enclosure surfaces to match original finishes.
- 3.7 Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A.
- 3.8 Grounding: Provide equipment grounding connections for electric heaters as indicated. Tighten connections to comply with tightening torque values specified in UL Std 486A to assure permanent and effective grounding.
- 3.9 Upon completion of installation of electric heaters, and after the building circuitry has been energized, test heating units to demonstrate capability and compliance with requirements. Where possible, field correct malfunctioning units, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- 3.10 Replace electric heaters and accessories which are damaged. Remove damaged items from the construction site.

END OF SECTION

SECTION 31 62 13 - CONCRETE PILES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes solid, precast, prestressed concrete piles.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For concrete piles. Prepared by or under the supervision of a qualified professional engineer detailing fabrication and lifting devices necessary for handling and driving piles.
 - 1. Indicate pile dimensions, cross sections, locations, and sizes. Show details of pile splices and shoes.
 - 2. Indicate types of reinforcement, including prestressing strand, and detail fabricating, bending, and placing.
 - 3. Indicate layout and dimensions, and identify each pile. Indicate welded connections by AWS standard symbols. Detail cast-in hardware.
 - 4. Indicate transportation, storage, and lifting points.
- C. Delegated Design Submittal: For concrete piles.
 - 1. Indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturer testing agency.
- B. Welding certificates.
- C. Design Mixes: For each concrete mix.
- D. Material Certificates: For steel reinforcements prestressing strand and concrete admixtures.
- E. Material Test Reports: For concrete materials.

- F. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.
- G. Static Pile Test Reports: Submit within three days of completing each test.
- H. Pile-Driving Records: Submit within three days of driving each pile.
- I. Certified Piles Survey: Submit within seven days of pile driving completion.
- J. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Engineering Responsibility: Assumes engineering responsibility to comply with requirements in "Performance Requirements" Article by engaging a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data for piles.
 - 2. PCI Plant Certification Program: Participates in PCI's Plant Certification Program and is designated a PCI-Certified Plant for C2 product group and category, or better.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
 - 1. Installer's responsibility includes engaging a qualified professional engineer to prepare pile-driving records.
- C. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.
- D. Design Practices: Comply with ACI 318 and the recommendations in PCI Committee Report: "Recommended Practice for Design, Manufacture and Installation of Prestressed Concrete Piling."
- E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for piles, comply with applicable requirements in PCI MNL-116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- F. Comply with requirements in ACI 301, "Specifications for Structural Concrete."
- G. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent cracking, distorting, warping, or other physical damage, and so markings are visible.
- B. Lift and support piles only at designated lifting or supporting points as shown on Shop Drawings.

1.7 FIELD CONDITIONS

- A. Protect structures, underground utilities, and other construction from damage caused by pile driving.
- B. Site Information: A geotechnical report has been prepared for this Project and is referenced elsewhere in the Project Manual for information only.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design piles, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Piles withstand transportation, erection, and driving stresses and design loads within limits indicated and under conditions existing at Project site.
 - 1. Design Loads: See structural general notes.

2.2 MOLD MATERIALS

- A. Molds: Provide molds of metal, plastic, wood, or another material that is nonreactive with concrete and that produces required finish surfaces.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.
- B. Plain and Deformed Steel Wire: ASTM A1064/A1064M, galvanized.
- C. Epoxy-Coated-Steel Wire: ASTM A884/A884M, Class A coated, deformed.

2.4 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A416/A416M, Grade 250 or 270; uncoated, seven-wire, low-relaxation strand.

2.5 CONCRETE MATERIALS

- A. General: Limit water-soluble chloride ions in concrete to the maximum percentage by mass of cementitious material permitted by ACI 318, but not more than 0.06 percent.
- B. Portland Cement: ASTM C150/C150M, Type II, of same type, brand, and source.
 - 1. Fly Ash: ASTM C618, Class C or F.
 - 2. Silica Fume: ASTM C1240, amorphous silica.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL-116, ASTM C33/C33M, with coarse aggregates complying with Class 4S. Provide aggregates from single source.
 - 1. Nominal Maximum Size of Aggregate: 3/4 inch.
- D. Water: Potable, free of deleterious material that may affect color stability, setting, or strength of concrete, and complying with chemical limits of PCI MNL-116.
- E. Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures.
 - 1. Air-Entraining Admixture: ASTM C260/C260M.
 - 2. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 3. Retarding Admixture: ASTM C494/C494M, Type B.
 - 4. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 5. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.
 - 6. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 7. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 - 8. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

2.6 PILE ACCESSORIES

2.7 CONCRETE MIXES

- A. Prepare design mixes for each type of concrete required.
 - 1. Limit use of fly ash and silica fume to not exceed, in total, 25 percent of portland cement by weight.
- B. Design mixes may be prepared by a qualified independent testing agency or by qualified personnel at precast manufacturing plant at precast manufacturer's option.
- C. Proportion mixes by either laboratory trial batch or field-test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with

the following properties:

1. Maximum Water-Cementitious Material Ratio: 0.40.

2.8 FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete placement and temperature changes and for pretensioning and detensioning operations. Maintain molds to provide completed piles of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL-116 and PCI MNL-135.
 1. Unless molds are stripped before detensioning, design molds so stresses are not induced in piles due to deformation of concrete under prestress or movement during detensioning.
 2. Chamfer edges and corners of square piles.
- B. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
 1. Accurately position, support, and secure reinforcement against displacement by molds, construction, or concrete placement. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
 2. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- C. Prestress tendons for piles by either pretensioning or post-tensioning methods. Comply with PCI MNL-116.
- D. Pile Shoes: Accurately position and secure pile shoes at pile tips so as to not affect pile alignment during driving. Weld pile shoes to longitudinal reinforcements.
- E. Mix concrete according to PCI MNL-116 and requirements in this Section. After initial concrete batching, no additional water may be added.
- F. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in piles. Comply with requirements in PCI MNL-116 for measuring, mixing, transporting, and placing concrete.
 1. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL-116.
 2. Comply with ACI 306.1 procedures for cold-weather concrete placement.
 3. Comply with ACI 305R recommendations for hot-weather concrete placement.
- G. Identify pickup points of piles with permanent markings that correspond with markings

indicated on Shop Drawings. Imprint casting date on each pile.

- H. Cure concrete, according to requirements in PCI MNL-116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
- I. Delay detensioning piles until concrete has attained at least 70 percent of its compressive strength as established by test cylinders cured under the same conditions as concrete.
 - 1. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 - 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
- J. Where ends of strands are not enclosed or covered, cut flush and cover with a high-strength mortar bonded to unit with an epoxy-resin bonding agent.
- K. Fabricate precast, prestressed concrete piles straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL-116 and PCI MNL-135 product tolerances.
- L. Finish: Fabricate concrete piles with normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.
 - 1. Finish unformed surfaces by trowel unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
- M. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until driven.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate pile manufacturer's quality-control and testing methods.
 - 1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency, and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- B. Testing: Test and inspect piles according to PCI MNL-116.
 - 1. Strength of piles will be considered deficient if units fail to comply with requirements.

- C. If there is evidence that strength of piles may be deficient or may not comply with PCI MNL-116 requirements, Owner will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42/C42M.
 - 1. A minimum of three representative cores are to be taken from piles of suspect strength, from locations directed by Architect.
 - 2. Cores are to be tested, following immersion in water, in a wet condition in accordance with ACI 301 if piles are wet under service conditions.
 - 3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is at least 85 percent of the 28-day design compressive strength and no core compressive strength is less than 75 percent of the 28-day design compressive strength.
 - 4. Test results are to be reported in writing on same day that tests are performed, with copies to Architect, Contractor, and pile manufacturer. Test reports are to include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete manufacturer.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of pile represented by core tests; design compressive strength; type of break; compressive strength at break, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- D. Patching: If core test results are satisfactory and piles comply with requirements, solidly fill core holes with patching mortar and finish to match adjacent pile surfaces.
- E. Piles will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches above bottom of footing or pile cap.

3.2 DRIVING EQUIPMENT

- A. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.

1. Use pile hammer capable of adjustment to deliver reduced impact to maintain tensile stress within 70 percent of yield strength of pile reinforcement.
- B. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
- C. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that hold the full length of pile firmly in position and in axial alignment with hammer.

3.3 DRIVING PILES

- A. General: Continuously drive piles to elevations or penetration resistance indicated. Establish and maintain axial alignment of leads and piles before and during driving.
- B. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.
- C. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
 1. Location: 0.5 inches from location indicated after initial driving, and 1 inch after pile driving is completed.
 2. Plumb: Maintain a maximum of 1 inch, measured when pile is aboveground in leads.
- D. Withdraw damaged or defective piles and piles that exceed driving tolerances, and install new piles within driving tolerances.
 1. Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches.
 2. Fill holes left by withdrawn piles as directed by Architect.
- E. Cut off tops of driven piles square with pile axis and at elevations indicated.
- F. Pile-Driving Records: Maintain accurate driving records for each pile. Include the following data:
 1. Project name and number.
 2. Name of Contractor.
 3. Type of pile and date of casting.
 4. Pile location in pile group and designation of pile group.
 5. Sequence of driving in pile group.
 6. Pile dimensions.
 7. Ground elevation.
 8. Elevation of tips after driving.
 9. Final tip and cutoff elevations of piles after driving pile group.
 10. Records of redriving.
 11. Elevation of splices.

12. Type, make, model, and rated energy of hammer.
13. Weight and stroke of hammer.
14. Type of pile-driving cap used.
15. Cushion material and thickness.
16. Actual stroke and blow rate of hammer.
17. Pile-driving start and finish times, and total driving time.
18. Time, pile-tip elevation, and reason for interruptions.
19. Number of blows for every 12 inches of penetration, and number of blows per 1 inch for the last 6 inches of driving.
20. Pile deviations from location and plumb.
21. Preboring, jetting, or special procedures used.
22. Unusual occurrences during pile driving.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 1. Pile foundations.
- B. Tests and Inspections:
 1. Dynamic Pile Testing: High-strain dynamic monitoring is to be performed and reported according to ASTM D4945 during initial driving and during restriking on five single piles.
- C. Piles will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.5 DISPOSAL

- A. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION 31 62 13

SECTION 31 62 19 - TIMBER PILES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes round timber piles.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For timber piles. Show fabrication and installation details for piles, including details of driving shoes, tips or boots, and pile butt protection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Round timber pile treatment data as follows, including chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material:
 - 1. For each type of preservative-treated timber product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
- C. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.
- D. Pile-Driving Records: Submit within three days of driving each pile.
- E. Certified Piles Survey: Submit within seven days of pile driving completion.
- F. Field quality-control reports.
- G. Material Certificates: For preservative-treated piles. Indicate type of preservative used and net amount of preservative retained.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
 - 1. Installer's responsibility includes engaging a qualified professional engineer to prepare pile-driving records.
- B. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent breaks, cuts, abrasions, or other physical damage and as required by AWP A M4.
 - 1. Do not drill holes or drive spikes or nails into pile below cutoff elevation.

1.7 FIELD CONDITIONS

- A. Protect structures, underground utilities, and other construction from damage caused by pile driving.
- B. Site Information: A geotechnical report has been prepared for this Project and is referenced elsewhere in the Project Manual for information only.

PART 2 - PRODUCTS

2.1 TIMBER PILES

- A. Round Timber Piles: ASTM D25, unused, clean peeled, one piece from butt to tip; of the following species and size basis:
 - 1. Species: Southern yellow pine.
 - 2. Size Basis: Tip circumference.
- B. Pressure-treat round timber piles according to AWP A U1 as follows:
 - 1. Service Condition: UC5C Marine Use Southern Waters
 - 2. Treatment: Waterborne preservative.

2.2 FABRICATION

- A. Pile Tips: Cut and shape pile tips to accept driving shoes. Fit and fasten driving shoes to pile tips according to manufacturer's written instructions.
- B. Pile Butt: Trim pile butt and cut perpendicular to longitudinal axis of pile. Chamfer and

shape butt to fit tightly to driving cap of hammer.

- C. Field-Applied Wood Preservative: Treat field cuts, holes, and other penetrations according to AWPAC M4.
 - 1. Coal-tar roofing cement for treating drilled holes or sealing cutoffs shall be free of asbestos.
- D. Pile Splices: Splices are not permitted.
- E. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until driven.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches above bottom of footing or pile cap.

3.2 DRIVING EQUIPMENT

- A. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.
- B. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
- C. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that hold the full length of pile firmly in position and in axial alignment with hammer.

3.3 DRIVING PILES

- A. General: Continuously drive piles to elevations or penetration resistance indicated. Establish and maintain axial alignment of leads and piles before and during driving.
- B. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.
- C. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
 - 1. Location: 0.5 inches from location indicated after initial driving, and 1 inch after pile driving is completed.

2. Plumb: Maintain from vertical, or a maximum of 1 inch, measured when pile is aboveground in leads.
- D. Withdraw damaged or defective piles and piles that exceed driving tolerances, and install new piles within driving tolerances.
 1. Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches.
 2. Fill holes left by withdrawn piles as directed by Architect.
- E. Cut off butts of driven piles square with pile axis and at elevations indicated.
 1. Cover cut-off piling surfaces with caps overlapping pile end by minimum 2 inches according to AWWA M4.
- F. Pile-Driving Records: Maintain accurate driving records for each pile. Include the following data:
 1. Project name and number.
 2. Name of Contractor.
 3. Pile species.
 4. Pile location in pile group and designation of pile group.
 5. Sequence of driving in pile group.
 6. Pile dimensions.
 7. Ground elevation.
 8. Elevation of tips after driving.
 9. Final tip and cutoff elevations of piles after driving pile group.
 10. Records of redriving.
 11. Elevation of splices.
 12. Type, make, model, and rated energy of hammer.
 13. Weight and stroke of hammer.
 14. Type of pile-driving cap used.
 15. Cushion material and thickness.
 16. Actual stroke and blow rate of hammer.
 17. Pile-driving start and finish times, and total driving time.
 18. Time, pile-tip elevation, and reason for interruptions.
 19. Number of blows for every 12 inches of penetration, and number of blows per 1 inch for the last 6 inches of driving.
 20. Pile deviations from location and plumb.
 21. Preboring, jetting, or special procedures used.
 22. Unusual occurrences during pile driving.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 1. Pile foundations.

- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections:
 - 1. Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D4945 during initial driving and during restriking on five single piles.

3.5 DISPOSAL

- A. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION 31 62 19