

V-1 IMPROVEMENTS

TECHNICAL SPECIFICATIONS

DATED: MARCH 2023

PREPARED FOR:

ENGLEWOOD WATER DISTRICT

PREPARED BY:

**GIFFELS-WEBSTER ENGINEERS, INC.
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GWE
Giffels-Webster
Engineers, Inc.

I HEREBY CERTIFY THAT THESE TECHNICAL SPECIFICATIONS WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF FLORIDA.

DENNIS J. CROYLE, PE
FLORIDA LICENSE # 82287
DATE:_____

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

DIVISION 1 - GENERAL REQUIREMENTS

01001	General Work Requirements
01010	Summary of Work
01025	Measurement and Payment-Sewer
01027	Applications for Payment
01065	Permits and Fees
01200	Project Meetings
01260	Contract Modification Procedures
01300	Submittals
01310	Progress Schedules
01370	Schedule of Values
01400	Quality Control
01410	Testing and Testing Laboratory Services
01590	Temporary Facilities and Construction Field Office
01610	Delivery, Storage, and Handling
01650	Pump Station Start-up and Testing
01700	Project Closeout
01720	Project Record Documents
01720.1	Vacuum Record Drawing Example
01720.2	Record Drawing Example

DIVISION 2 - SITE WORK

02140	Dewatering
02215	Finish Grading
02220	Excavating, Backfilling and Compacting

Roadwork

02576	Concrete Sidewalks and Driveways
02578	Solid Sodding

Pressure Pipe

02730 S Owner Supply

DIVISION 3 - CONCRETE

03100 Concrete Formwork
03200 Concrete Reinforcement
03300 Cast-in-Place Concrete

DIVISION 4 - MASONRY

04810 Unit Masonry Assemblies

DIVISION 5 - METALS

05120 Structural Steel
05500 Miscellaneous Metals

DIVISION 6 - WOOD, PLASTICS, AND COMPOSITES

06100 Rough Carpentry
06176 Metal Plate Connected Wood Trusses

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

07411 5V Crimp Aluminum Panels
07620 Sheetmetal Flashing and Trim
07621 Gutters and Downspouts
07901 Joint Sealants

DIVISION 8 - OPENINGS

08710 Doors Hardware

DIVISION 9 - FINISHES

09250 Gypsum Drywall
09670 Slip Retardant Epoxy Floor Coating
09865 Surface Preparation and Shop Prime Painting
09900 Painting

DIVISION 10 – SPECIALTIES

10200 Louvers

DIVISION 11 – EQUIPMENT**DIVISION 12 - FURNISHINGS - NOT USED****DIVISION 13 - SPECIAL CONSTRUCTION – NOT USED**

DIVISION 14 - CONVEYING EQUIPMENT - NOT USED

DIVISION 15 - MECHANICAL

15060	Pipe Penetrations
15062	Ductile Iron Pipe and Fittings
15064	Polyvinyl Chloride (PVC) Pipe and Fittings
15111	Gate Valves
15112	Butterfly Valves
15135	Meters and Gauges
15140	Supports and Anchors
15400	Plumbing
15453	Vacuum Station Pumping Accessory Equip. Contractor Purchased

DIVISION 16 – ELECTRICAL

16050	Basic Electrical Materials and Methods
16090	Supporting Devices
16120	Wires and Cables
16130	Raceways and Boxes
16139	Underground Electrical Conduit
16140	Wiring Devices
16195	Electrical Identification
16452	Grounding
16476	Disconnect Switches
16495	Transfer Switches

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SECTION 01001
GENERAL WORK REQUIREMENTS

PART 1 - GENERAL	2
1.01 NOTICE AND SERVICE	2
1.02 WORK TO BE DONE	2
1.03 DRAWINGS AND PROJECT MANUAL	2
1.04 PROTECTION AND RESTORATION.....	3
1.05 PUBLIC NUISANCE.....	4
1.06 MAINTENANCE OF SERVICE.....	5
1.07 TRANSFER OF SERVICE.....	5
1.08 LABOR	5
1.09 MATERIALS AND EQUIPMENT	6
1.10 MANUFACTURER'S SERVICE	6
1.11 INSPECTION AND TESTING	7
1.12 PROJECT SITE AND ACCESS.....	9
1.13 UTILITIES	10
1.14 RELATED CONSTRUCTION REQUIREMENTS	13
1.15 CONSTRUCTION NOT PERMITTED	16
PART 2 - PRODUCTS (NOT USED).....	16
PART 3 - EXECUTION (NOT USED).....	16

SECTION 01001
GENERAL WORK REQUIREMENTS

PART 1 - GENERAL

1.01 NOTICES

- A. All notices or other papers required to be delivered by the Contractor shall be delivered to the OWNER

1.02 WORK TO BE DONE

- A. The Contractor shall furnish all labor, materials, equipment, tools, services, and incidentals to complete all work required by these specifications and as shown on the Drawings, at a rate of progress which will ensure completion of the Work within the Contract Time stipulated.
- B. The Contractor shall perform the Work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, clean up, replacements, and restoration required as a result of damages caused during this construction.
- C. The Contractor shall comply with all County, State, Federal, and other codes, which are applicable to the proposed Work.
- D. All newly constructed Work shall be carefully protected from injury in any way. No wheeling, walking, or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the Contractor at his own expense.
- E. Scope of Work: See Section 01010 "Summary of Work" and the Bid Schedule for details.

1.03 DRAWINGS

- A. The Work shall be performed in accordance with the Drawings and Specifications prepared by the OWNER/Professional. All work and materials shall conform to the Utilities Standards Specifications and Standard Details, latest edition or as indicated in these Specifications or Drawings.
- B. The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications or other data received from the OWNER/Professional, and shall notify same, in writing, of all errors, omissions, conflicts and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory Work, faulty construction or improper operation resulting there from, nor from rectifying such conditions at his own expense.
- C. All schedules are given for the convenience of the OWNER and the Contractor and are

not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under this Contract.

D. Intent:

1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified either in the Drawings or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.
2. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Specifications. Such items shall be provided by the Contractor in accordance with the specification on the Drawings.
3. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

E. Refer to the Contract for the order of precedence of items and documents.

1.04 PROTECTION AND RESTORATION

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every means of protection necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or the Contractor shall make good the damage in other manner acceptable to the OWNER/Professional.
- B. Protection of Trees and Shrubs
1. Protect with boxes or other barricades.
 2. Do not place excavated material so as to injure trees or shrubs.
 3. Install pipelines in short tunnels between and under root systems.
 4. Support trees to prevent root disturbance during nearby excavation.
- C. Tree and Limb Removal
1. Tree limbs, which interfere with equipment operation and are approved for pruning, shall be neatly trimmed and the tree cut coated with tree paint.
 2. The OWNER may order the Contractor, for the convenience of the OWNER, to remove trees along the line or trench excavation. The Contractor shall obtain any permits required for removal of trees. Ordered tree removal shall be paid for under the appropriate Contract Items.
- D. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be

replaced by the Contractor with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.

- E. Lawn Areas: All lawn areas disturbed by construction shall be replaced with like kind to a condition similar or equal to that existing before construction. Where sod is to be removed, it shall be carefully removed, and the same re-sodded, or the area where sod has been removed shall be restored with new sod in the manner described in the applicable section.
- F. Where fencing, walls, shrubbery, grass strips or area must be removed or damaged incident to the construction operation, the Contractor shall, after completion of the work, replace or restore to the original condition.
- G. The cost of all labor, materials, equipment, and work for restoration shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.

1.05 PUBLIC NUISANCE

- A. The Contractor shall not create a public nuisance including, but not limited to, encroachment on adjacent lands, flooding of adjacent lands, or excessive noise.
- B. Sound levels measured by the OWNER/Professional shall not exceed 45 dBA from 8 p.m. to 8 a.m. or 55 dBA 8 a.m. to 8 p.m. This sound level shall be measured at the exterior of the nearest exterior wall of the nearest residence. Levels at the equipment shall not exceed 85 dBA at any time. Sound levels in excess of these values are sufficient cause to have the Work halted until equipment can be quieted to these levels. Work stoppage by the OWNER/Professional for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to, completion dates and bid amounts.
- C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.06 MAINTENANCE OF SERVICE

- A. Unless noted otherwise on the plans, the operation of the existing water, reclaimed water or wastewater facility on each of the respective locations shall remain in service until the transfer of service has been completed. The Contractor shall, prior to interrupting any utility service (water, sewer, etc.) for the purpose of making cut-ins to the existing lines or for any other purposes, contact the OWNER and make arrangements for the interruption which will be satisfactory to the OWNER.
- B. Utility lines that are damaged during construction shall be repaired by the Contractor and service restored within 4-hours of the breakage. The OWNER retains the option of repairing any damage to utility pipes in order to expedite service to the customers. The Contractor will remain responsible for all costs

associated with the repair.

1.07 TRANSFER OF SERVICE

- A. When the OWNER has accepted a proposed facility and placed it into operation, the transfer of service is complete. The Contractor may begin the work of removing the existing or temporary facilities.

1.08 LABOR

- A. Supervision: The Contractor shall supervise and direct the Work efficiently and with his best skills and attention. The Contractor shall have a competent, English speaking superintendent or representative, who shall be on the site of the Project at all working hours, and who shall have full authority by the Contractor to direct the performance of the Work and make arrangements for all necessary materials, equipment, and labor without delay.

1.09 MATERIALS AND EQUIPMENT

A. MANUFACTURER

1. All transactions with the manufacturers or Subcontractors shall be through the Contractor, unless the Contractor and the OWNER/Professional request that the manufacturer or Subcontractor communicate directly with the OWNER/Professional. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.
2. All workmanship and materials shall be of the highest quality. The equipment shall be the product of manufacturers who are experienced and skilled in the field with an established record of research and development. No equipment will be considered unless the manufacturer has designed and manufactured equipment of comparable type and size and have demonstrated sufficient experience in such design and manufacture.
3. No material shall be delivered to the Site without prior approval of the OWNER/Professional.
4. All apparatus, mechanisms, equipment, machinery, and manufactured articles for incorporation into the Project shall be the new (most current production at time of bid) and unused standard products of recognized reputable manufacturers.
5. Manufactured and fabricated products:
 - a. Design, fabricate and assemble in accord with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Any two or more pieces of material or equipment of the same kind, type or classification, and being used for identical types of service, shall be made by the same manufacturer.
 - d. Products shall be suitable for service conditions as specified and as stated by manufacturer.

- e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
- f. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.10 MANUFACTURER'S SERVICE

- A. Where service by the manufacturer is specified to be furnished as part of the cost of the item of equipment, the Work shall be at the Contractor's expense.
- B. The services provided shall be by a qualified manufacturer's service representative to check and verify the completed installation, place the equipment in operation, and instruct the OWNER's operators in the operation and maintenance procedures. Such services are to be for period of time and for the number of trips specified. A working day is defined as a normal 8-hour working day on the job and does not include travel time.
- C. The services shall further demonstrate to the OWNER/Professional's complete satisfaction that the equipment will satisfactorily perform the functions for which it has been installed.

1.11 INSPECTION AND TESTING

A. General

- 1. All materials and equipment furnished by the Contractor shall be subject to the inspection, review and acceptance of the OWNER and meet the requirements as outlined in the OWNER Utilities Standards and Construction Specifications Manual. If in the testing of any material or equipment it is ascertained by the OWNER/Professional that the material or equipment does not comply with the Contract, the Contractor shall be notified thereof, and the Contractor will be directed to refrain from delivering said material or equipment, or to remove it promptly from the Site or from the Work and not accepted by the OWNER shall be replaced with acceptable material, without cost to the OWNER.
- 2. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
- 3. The Contractor shall give notice in writing to the OWNER sufficiently in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the OWNER shall arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials; or the OWNER will notify the Contractor that the inspection will be made at a point other than the point of manufacture; or the OWNER will notify the Contractor that inspection will be waived.
- 4. When inspection is waived or when the OWNER/Professional so requires, the Contractor shall furnish to the OWNER authoritative evidence in the form of

Certificates of Manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include five (5) copies of the results of physical tests and chemical analysis, where necessary, that have been made directly on the product or on similar products of the manufacturer.

5. The Contractor must comply with these provisions before shipping any material. Such inspections by the OWNER shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

B. Cost

1. The CONTRACTOR shall employ and pay for the services of an independent testing laboratory to perform testing indicated on the Contract Documents, or at the OWNER's discretion to ensure conformity with the Contract Documents.
2. The cost of field leakage and pressure tests and shop tests of materials and equipment specifically called for in the Contract Documents shall be borne by the Contractor. Such costs shall be deemed to be included in the Contract price.
3. The Contractor shall pay for all work required to uncover, remove, replace, retest, etc., any work not tested due to the Contractor's failure to provide the 48-hours advance notice or due to failed tests.

C. Shop Testing

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function or special requirements are specified shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the worksite until the OWNER/Professional notifies the Contractor, in writing, that the results of such tests are acceptable.
2. The manufacturing company shall provide five (5) copies of the manufacturer's actual shop test data and interpreted results signed by a responsible official of the manufacturing company and notarized, showing conformity with the Contract Documents as a prerequisite for the acceptance of any equipment. The cost of shop tests (excluding cost of OWNER's representative) and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor and shall be included in the Contract price.

D. Field Testing:

1. The OWNER shall employ and pay for services of an independent testing laboratory to perform testing specifically indicated in the Contract Documents. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract. The Contractor shall provide compensation for retesting of all failed tests.
2. The OWNER may at any time during the progress of the Work, request additional testing beyond that which is specified in the Contract. This testing will be at the OWNER's expense. Contractor shall:
 - a. Cooperate with laboratory personnel, provide access to the Project.

- b. Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.
 - c. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes, which require control by the testing laboratory.
- E. Demonstration Tests: Upon completion of the Work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance or demonstration tests as specified or required to provide compliance with the Contract Documents. The Contractor shall furnish all labor, fuel, energy, water and all other equipment necessary for the demonstration tests at no additional cost to the OWNER.
- F. Final Inspection: Prior to preparation of the final payment application, a final inspection will be performed by the OWNER to determine if the Work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents. See also Section 01700 "Project Closeout."
- G. Inspection by existing utility owners: The Contractor shall pay for all inspections during the progress of the work required and provided by the owner of all existing public utilities paralleling or crossing the Work, as shown on the Drawings. All such inspection fees shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.
- H. Inspection by Other Agencies: The Florida Department of Transportation, the Florida Department of Environmental Protection, and other authorized governmental agencies shall have free access to the site for inspecting materials and work, and the Contractor shall afford them all necessary facilities and assistance for doing so. Any instructions to the Contractor resulting from these inspections shall be given through the OWNER. These rights of inspections shall not be construed to create any contractual relationship between the Contractor and these agencies.

1.12 PROJECT SITE AND ACCESS

A. RIGHT-OF-WAY AND EASEMENTS

- 1. The use of public streets and alleys shall be such as to provide a minimum of inconvenience to the public and to other traffic. Any earth or other excavated material shall be removed by the Contractor and the streets cleaned to the satisfaction of the OWNER.
- 2. The Contractor shall not enter or occupy private land outside of easements, except by written permission of the property owner.
- 3. At the time of the Pre-Construction meetings, the Contractor shall become fully acquainted with the status of all easements. Should easements not be acquired by the OWNER in specific areas of the Work, the Contractor shall sequence and schedule his work therein so as not to interfere with the progress of work in other areas of the Project. Any rescheduling of work due to easement acquisitions shall be performed by the Contractor at no additional cost to the OWNER. The OWNER agrees that it will make every effort to acquire all remaining easements with all speed and diligence

possible so as to allow the completion of the Work within the Contract time.

B. ACCESS

1. Neither the material excavated nor the materials or equipment used in the construction of the Work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.
2. Access to businesses located adjacent to the project site must be maintained at all times. Contractor may prearrange the closing of business access with the business Owner. Such prearranged access closing shall not exceed two (2) hours. Property drainage and grading shall be restored and all construction debris removed within 48-hours of backfilling trench.
3. Contractor agrees that representatives of the OWNER and any governmental agents will have access to the Work wherever it is in preparation or progress and that the Contractor shall provide facilities for such access and inspection.

1.13 UTILITIES

A. UTILITY CONSTRUCTION

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto, whether owned or controlled by governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electric, telephone, sewerage, drainage or water. Other public or private property, which may be affected by the Work, shall be deemed included hereunder.
2. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required.
3. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to the limits described by the OWNER. If any excavation becomes a hazard, or if it excessively restricts traffic at any point, the OWNER may require special construction procedures. As a minimum, the Contractor shall conform to the following restoration procedures:
 - a. Interim Restoration: All excavations shall be backfilled and compacted as specified by the end of each working day. For excavations within existing paved areas; limerock base or soil cement base (match existing) shall be spread and compacted to provide a relatively smooth surface free of loose aggregate material. At the end of each workweek, the S-I asphaltic surface course shall be completed and opened to traffic. Contractor shall coordinate his construction activity including density tests and inspections to allow sufficient time to achieve this requirement. All driveway cuts shall be backfilled, compacted, and limerock base spread and compacted immediately after installation. Contractor shall coordinate with the individual property owners prior to removing the driveway section. Any utility crossing an existing roadway, parking lot or other paved area shall be patched by the end of the working day.

- b. All pipe and fittings shall be neatly stored in a location, which will cause the least disturbance to the public. All debris shall be removed and properly disposed of by the end of each working day.
- c. Final Restoration Overlay: After completing all installations, and after testing of the pipe (but no sooner than 30-days after applying the structural asphaltic surface), final restoration shall be performed. In no event shall final restoration begin after substantial completion. Final restoration shall provide an final asphaltic overlay as specified in an uninterrupted continuous operation until completion. Any additional restoration required after testing shall be repaired in a timely manner at no additional cost to the OWNER.
- d. Maintenance of all restored facilities shall be the Contractor's responsibility. This maintenance shall be performed on an on-going basis during the course of construction. The Contractor's Progress Schedule shall reflect the above restoration requirements.
- e. Additional Restoration for Work in Business or Commercial Districts: The Contractor shall restore all private property, damaged by construction, to its original condition. Access to businesses located adjacent to the project site must be maintained at all times. Contractor may prearrange the closing of business accesses with the business owner. Such prearranged access closing shall not exceed two (2) hours. Property drainage and grading shall be restored within 24-hours of backfilling trench.

B. EXISTING UTILITIES

- 1. The locations of all existing underground piping, structures and other facilities are shown based on information received from the respective owner. The locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping, conduit and cables to be encountered. It is the Contractor's responsibility to verify all existing underground piping, structures and other facilities.
- 2. The Contractor shall, at all times, employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of existing utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, utility services; and shall cooperate fully with the owners thereof to that end.
- 3. When existing facilities are found to be in conflict with the Work, the OWNER reserves the right to modify alignments to avoid interference with existing facilities.
- 4. All utilities, which do not interfere with the work, shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the OWNER. Any existing facilities, which require operation to facilitate repairs, shall be operated only by the owner of the respective utility.
- 5. It is the responsibility of the Contractor to ensure that all utility and/or poles, the stability of which may be endangered by the proximity of excavation, be temporarily stayed and/or shored in position while work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice of any such excavation.

C. NOTICES

1. All governmental utility departments and other owners of public utilities, which may be affected by the Work, will be informed in writing by the Contractor two (2) weeks after the execution of the Contract or Contracts covering the Work. Such notice will be sent out in general, and directed to the attention of the governmental utility departments and other owners of public utilities for such installations and structures as may be affected by the Work.
2. The Contractor shall comply with Florida Statute 553.851 regarding protection of underground gas pipelines. Evidence of notification to the gas pipeline owner shall be furnished to the OWNER within two (2) weeks after the execution of the Contract.
3. It shall be the Contractor's responsibility to contact utility companies at least 72-hours in advance of breaking ground in any area or on any unit of the work so maintenance personnel can locate and protect facilities, if required by the utility company.
4. The Contractor shall give a minimum five (5) working day notice to utility personnel prior to interrupting a utility service (water, sewer, etc.).

D. EXPLORATORY EXCAVATIONS

1. Exploratory excavations shall be conducted by the Contractor for the purpose of locating underground pipelines or structures in advance of the construction. Test pits shall be excavated in areas of potential conflicts between existing and proposed facilities and at piping connections to existing facilities a minimum of 48-hours or 1,000-feet in advance of work. If there is a potential conflict, the Contractor shall notify the OWNER/Professional immediately. Information on the obstruction to be furnished by the Contractor shall include: Location, Elevation, Utility Type, Material and Size. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the OWNER.

E. UTILITY CROSSINGS

1. It is intended that wherever existing utilities must be crossed, deflection of the pipe within specified limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated on the Drawings. However, when in the opinion of the OWNER this procedure is not feasible, the OWNER may direct the use of fittings for a utility crossing or conflict transition as detailed on the Drawings.

F. RELOCATIONS

1. Relocations shown on the Drawings: Public utility installations or structures, including but not limited to poles, signs, fences, piping, conduits and drains that interfere with the positioning of the work which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as part of the general cost of doing the Work and shall be included in the prices bid for the various contract items. No separate payment shall be made therefore.
2. Relocations not shown on the Drawings
 - a. Where public utility installations or structures are encountered during the course of the work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the OWNER, removal, relocation, replacement or rebuilding is necessary to complete the Work, such work shall be accomplished

- by the utility having jurisdiction, or such work may be ordered, in writing by the OWNER, for the Contractor to accomplish.
- b. If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required.
 - c. If such work is accomplished by the Contractor, it will be paid for as a Change Order.
3. All existing castings, including valve boxes, junction boxes, manholes, hand holes, pull boxes, inlets and similar structures in the areas of construction that are to remain in service and in areas of trench restoration and pavement replacement, shall be adjusted by the Contractor to bring them flush with the surface of the finished work.
 4. All existing utility systems which conflict with the construction of the work herein, which can be temporarily removed and replaced, shall be accomplished at the expense of the Contractor. Work shall be done by the utility unless the utility approves in writing that the Work may be done by the Contractor.

1.14 RELATED CONSTRUCTION REQUIREMENTS

A. TRAFFIC MAINTENANCE

1. Refer to Section 01570 – Maintenance of Traffic

B. BARRIER AND LIGHTS

1. The Contractor shall exercise extreme care in the conduct of the Work to protect health and safety of the workmen and the public. The Contractor shall provide all protective measures and devices necessary, in conformance with applicable local, state and federal regulations. Protective measures shall include but are not limited to barricades, warning lights/flashers and safety ropes.
2. All equipment and vehicles operating within 10-feet of the roadway shall have flashing strobe lights attached.

C. DEWATERING AND FLOTATION

1. The Contractor, with his own equipment, shall do all pumping necessary to dewater any part of the work area during construction operations to insure dry working conditions. The Contractor shall take the necessary steps to protect on-site and off-site structures. Damage to any structures due to dewatering shall be repaired or the structures replaced at the Contractor's expense.
2. The Contractor shall be completely responsible for any tanks, wetwells or similar structures that may become buoyant during the construction and modification operations due to the ground water or floods and before the structure is put into operation. The proposed final structures have been designed to account for buoyancy; however the Contractor may employ methods, means and techniques during construction which may affect the buoyancy of structures. The Contractor shall take the necessary steps to protect structures. Damage to any structures due to floating or flooding shall be repaired or the structures replaced at the Contractor's expense.
3. Contractor shall be responsible for any required permits for the discharge of ground water.

D. DUST AND EROSION CONTROL

1. The Contractor shall prevent dust nuisance from his operations or from traffic.
2. Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.
3. Temporary erosion controls include, but are not limited to, grassing, mulching, netting, watering and reseeding on-site surfaces and soil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the OWNER, FDEP and any other agency having jurisdiction.
4. Temporary sedimentation controls include, but are not limited to; silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the OWNER, FDEP and any other agency having jurisdiction.
5. The construction of temporary erosion and sedimentation control facilities shall be in accordance with the technical provision of section 104 "Prevention, Control, and Abatement of Erosion and Water Pollution" of the FDOT Standard Specifications for Road and Bridge Construction, latest edition.

E. LINES AND GRADES

1. All Work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the OWNER/Professional.
2. When the location of the Work is dimensioned on the Drawings, it shall be installed in that location; when the location of the Work is shown on a scaled drawing, without dimensions, the Work shall be installed in the scaled location unless the OWNER approves an alternate location for the piping. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve the Contractor from laying and jointing different or additional items where required. The OWNER/Professional may require detailed pipe laying drawings and schedules for project control.
3. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the project control points set by the OWNER, and shall be solely responsible for the accuracy thereof.
4. Water main and forcemain shall be installed to provide long uniform gradient or slope to pipe to minimize air pockets and air release valves. The stationing shown on the Drawings for air and vacuum release valve assemblies are approximate and the Contractor shall field adjust these locations to locate these valves at the highest point in the pipeline installed. All locations must be accepted by the OWNER.
5. To insure a uniform gradient for gravity pipe and pressure pipe, all lines shall be installed using the following control techniques as a minimum:
 - a. Gravity lines; continuous control, using laser beam technology.
 - b. Pressure lines; control stakes set at 50-foot intervals using surveyors' level instrument.

F. TEMPORARY CONSTRUCTION

1. Temporary fences: If, during the course of the Work, it is necessary to remove or disturb any fencing, the Contractor shall at his own expense, provide a suitable

- temporary fence which shall be maintained until the permanent fence is replaced.
2. Responsibility for Temporary Structures: In accepting the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary structures or work and for any damage which may result from their failure or their improper construction, maintenance or operation.

G. DAILY REPORTS

1. The Contractor shall submit to the OWNER's Representative daily reports of construction activities including non-work days. The reports shall be complete in detail and shall include the following information:
 - a. Days from Notice to Proceed; Days remaining to substantial and final completion.
 - b. Weather information
 - c. Work activities with reference to the Critical Path Method (CPM) schedule activity numbers (including manpower, equipment and daily production quantities for each individual activity).
 - d. Major deliveries
 - e. Visitors to site
 - f. Test records
 - g. New problems, and
 - h. Other pertinent information
2. A similar report shall be submitted for/by each Subcontractor.
3. The report(s) shall be submitted to the OWNER Representative within 2 days of the respective report date. Each report shall be signed by the Contractor's Superintendent or Project Manager. Pay request will not be processed unless daily reports are current.
4. If a report is incomplete, in error, or contains misinformation, a copy of the report shall be returned by the OWNER Representative to the Contractor's Superintendent or Project Manager with corrections noted. When chronic errors or omissions occur, the Contractor shall correct the procedures by which the reports are produced.

H. CLEANING

1. During Construction
 - a. During construction of the Work, the Contractor shall, at all times, keep the Site free from material, debris and rubbish as practicable and shall remove the same from any portion of the Site if, in the opinion of the OWNER, such material, debris, or rubbish constitutes a nuisance or is objectionable.
 - b. Provide on-site containers for the collection of waste materials, debris and rubbish and remove such from the Site periodically by disposal at a legal disposal area away from the Site.
 - c. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished. Use cleaning materials which will not create hazards to health or property and which will not damage surfaces. Use only those cleaning materials and methods recommended by the manufacturer of the surface material. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.
 - d. The Contractor shall remove from the site all surplus materials and temporary structures when no longer necessary to the Work at the direction of the OWNER.

2. Final Cleaning

- a. At the conclusion of the Work, all equipment, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and the Contractor shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances. Employ skilled workmen for final cleaning. Thoroughly clean all installed equipment and materials to a bright, clean, polished and new appearing condition. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- b. The Work shall be left in a condition as shown on the Drawings and the remainder of the site shall be restored to a condition equal or better than what existed before the Work.
- c. Prior to final completion, or OWNER occupancy, Contractor shall conduct an inspection of interior and exterior surfaces, and all work areas to verify that the entire Work is clean. The OWNER will determine if the final cleaning is acceptable.

1.15 CONSTRUCTION NOT PERMITTED

A. USE OF EXPLOSIVES

1. No blasting shall be done except as approved by the OWNER and the governmental agency or political subdivision having jurisdiction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

This Contract is for the replacement of the vacuum sewer equipment in the existing building and other improvements as shown on the Drawings and specified herein. The Work consists of furnishing all labor, equipment, and materials for the construction of the facilities consisting of, but not limited to the expansion of or improvements to the equipment and structures associated with the following:

1. Construction of a temporary owner supplied prefabricated vacuum station that will operate the collection system, including furnishing and installing all materials and equipment.
2. Construction of a new owner supplied prefabricated vacuum station equipment that will replace the existing vacuum station equipment.
3. Construction of the vacuum piping system onsite to connect both the temporary and new vacuum stations including furnishing and installing all pipe, fittings, and miscellaneous material. This includes installation of Airvac vacuum skids and assemblies.
4. Construction of a yard piping and improvements including furnishing and installing all pipe, fittings, ancillary equipment, and miscellaneous material.
5. Construction of a mulch bed and exhaust piping from the vacuum station and improvements including furnishing and installing all pipe, fittings, ancillary equipment, and miscellaneous material.
6. Construction of site work and improvements including driveways, storm pipe extension, and grading
7. Construction of building improvements including:
 - a. Demolition of existing building components and equipment
 - b. New roof assembly
 - c. Modifications to rough openings in masonry walls for louvers and doors
 - d. New bond beam to raise wall height
 - e. Structural steel mezzanine platform and stairs to carry vacuum equipment
 - f. Concrete deck
 - g. Interior framing
 - h. Bridge crane assembly
 - i. New electrical and instrumentation and upgrades
 - j. Paints and coatings
 - k. Concrete repairs
 - l. Exhaust fans
8. Construction of electrical and instrumentation work for both the temporary and permanent vacuum pump stations.

- a. The temporary vacuum station will include a cellular dialer for SCADA communications.
- b. The permanent system will be connected to a new DFS telemetry system for SCADA communications. The DFS scope of work will be purchased by the OWNER and coordinated by the Contractor.
9. Restoration and cleanup of all disturbed areas, including replacement of sod, drainage swales, pavement, drainage pipes, driveways, mailboxes and miscellaneous items within the ROW.
10. Provide complete testing and startup of system.
11. Certified as-builts

B. The Work shall be performed in accordance with the Drawings and Specifications prepared by the respective OWNER/Professional. Please note that separate drawings exist for the individual projects.

1.02 CONTRACTOR'S USE OF PREMISES

A. The Contractor shall assume full responsibility for the protection and safekeeping of products and materials at the job site. If additional storage or work areas are required, they shall be obtained by the Contractor at no additional cost to the Owner.

1.03 SEQUENCE OF WORK

A. The Contractor shall establish his work sequence based on the use of crews to facilitate completion of construction, testing and operation within the specified Contract Time.

B. The Contractor shall submit a schedule and work sequence to the EOR at least five (5) days prior to the Notice to Proceed.

1.04 PUBLIC UTILITY INSTALLATIONS AND STRUCTURES

A. Some of the utility contacts are listed on the plans for the Contractor's convenience.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. This Section specifies administrative and procedural requirements to define pay items and determine payable amounts, and includes but is not limited to:

- A. General Provisions
- B. Cash Allowances
- C. Work Not Paid for Separately
- D. Measurement for Payment
- E. Partial Payment for Stored Materials and Equipment

1.02 GENERAL PROVISIONS

A. This specification includes standard descriptions for all bid items. This Contract's specific bid items are listed in the Bid Schedule.

B. The total Contract Amount shall cover the Work required by the Contract Documents. All costs in connection with the successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction, equipment, and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices bid.

C. If used, all estimated quantities stipulated in the Bid Schedule or other Contract Documents are approximate and are to be used only (a) for the purpose of comparing the bids submitted for the Work, and (b) as a basis for determining an initial Contract Amount. The actual amounts of Work completed and materials furnished under unit price items may differ from the estimated quantities. The Owner does not express or by implication represent that the actual quantities involved will correspond exactly to the quantities stated in the Bid Schedule; nor shall the Contractor plead misunderstanding or deception because of such estimate or quantities or of the character, location or other conditions pertaining to the Work. Payment to the Contractor will be made only for the actual quantities of work performed or material furnished in accordance with the Drawings and other Contract Documents, and it is understood that the quantities may be increased or decreased as provided in the General Conditions.

D. If used, the unit prices listed in the Bid Schedule shall include all services, obligations, responsibilities, labor, materials, testing, devices, equipment, royalties and license fees, supervision, temporary facilities, construction equipment, bonds, insurance, taxes, clean up, traffic control, control surveys, field offices, close out, overhead and profit and all connections, appurtenances and any other incidental items of any kind or nature, as are necessary to complete the Work in accordance with the Contract Documents.

E. Except for mobilization/demobilization and project record documents, payment for Work will be based on the percent of completed work of each item in the Schedule of Values, including stored materials, as determined by the Owner. Progress of work in each item of the Schedule of Values will be determined separately by the Owner. However, the Owner will issue a single payment certificate for progress on the Contract.

F. The Contractor agrees that it will make no claim for damages, anticipated profits, or otherwise because of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefore.

G. Where payment by scale weight is specified under certain items, the Contractor shall provide suitable weighing equipment which shall be kept in accurate adjustment at all times and certified. The weighing of all material shall be performed by the Contractor in the presence and under the supervision of the Owner.

H. All schedules included in the Contract Documents are given for convenience and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quantity of materials and equipment included in work to be done under this Contract.

I. Where pipe fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve the Contractor from laying and jointing different or additional items where required.

J. All contracts shall be subject to 10% minimum retainage as defined in the General Conditions and the Agreement.

1.03 CASH ALLOWANCES

A. The Contractor shall include in the Total Bid Amount, all cash allowances stated in the Contract Documents. Items covered by these allowances shall be supplied for such amounts and by such persons as the County may direct.

B. The Contractor will obtain the County's written acceptance before providing equipment, materials or other Work under a cash allowance. Payments under a cash allowance will be made based on actual costs, excluding costs of general conditions, handling, unloading, storage, installation, testing, etc., which will be considered to be included within the Contract Price. Payments within the limits of any Allowance will exclude overhead and profit and bond and insurance premiums, since those costs will be considered to be included within the Contract Amount. The Contractor shall submit appropriate documentation to validate the actual cost of the item.

C. The amount of the allowance shall be adjusted accordingly by Change Order to recognize the allowable cost incurred by the Contractor.

1.04 WORK NOT PAID FOR SEPARATELY

A. Delivery: Payment for equipment delivery, storage or freight shall be included in the pay items including their installation and no other separate payment will be made therefore.

B. Bonds: Payment for bonds required by the Contract shall be included in the pay items for the Work covered by the required bonds and no separate payment will be made.

C. Preparation of Site: Payment for preparation of site shall be included in pay items proposed for the various items of Work and no separate payment will be made therefore. Preparation of site includes setting up construction plant, field offices and trailers, security fencing, shops, storage areas, sanitary and other facilities required by the specifications or state law or regulations; providing access to the site; payments of fees; general protection, temporary heat and utilities including electrical power; providing shop and working drawings, certificates and schedules; providing required insurance; preconstruction photographs and videos; clearing and grubbing; removal of existing pavements, sidewalks and curbs; trench excavation, sheeting, shoring and bracing; dewatering and disposal of surplus water; structural fill, backfill, compaction and grading; testing materials and apparatus; maintenance of drainage systems; appurtenant work; record drawing and close-out documentation; cleaning up; and all other work regardless of its nature which may not be specifically referred to in a Bid Item but is necessary for the complete construction of the project set forth by the Contract.

D. The Owner reserves the right to delete any item included in the Schedule of Values and decrease the Contract Price by the scheduled amount for the item deleted.

1.05 MEASUREMENT AND PAYMENT

A. Methods of Measurement - Generally:

A. Units of measurement shall be defined in general terms as follows:

- Linear Feet (LF)
- Square Feet (SF)
- Square Yards (SY)
- Cubic Yards (CY)
- Each (EA)
- Sacks (SK)
- Lump Sum (LS)

B. Unit Price Contracts/Items:

Linear Feet (LF) shall be measured along the horizontal length of the centerline of the installed material, unless otherwise specified. Pipe shall be measured along the length of the completed pipeline, regardless of the type of joint required, without deduction for the length of valves or fittings. Pipe included within the limits of lump sum items will not be measured.

Square Feet (SF), Square Yards (SY), Cubic Yards (CY), Each (EA) and Sacks (SK) shall be measured as the amount of the unit of measure installed and compacted within the limits specified and shown in the Specifications and Drawings. Slope angles and elevations shall be measured using land-surveying equipment. Contractor shall provide supporting documentation (i.e. drawings, delivery tickets, invoices, survey calculations, etc.) to verify actual installed quantities.

B. Lump Sum Contracts/Items - Generally:

A. Quantities provided in the Schedule of Values are for the purpose of estimating the completion status for progress payments. Payment will be made for each individual item on a percentage of completion basis as estimated by the Contractor and approved by the Owner.

B. Adjustments to costs provided in the accepted Schedule of Values may be made only by Change Order.

C. The Owner reserves the right to delete any item included in the Schedule of Values and decrease the Contract Price by the scheduled amount for the item deleted.

1.06 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Will only be considered as listed and agreed to in the provisions of the Contract between the County and the Contractor.

B. Submit stored materials log of proposed equipment and materials for which partial payment will be requested within 20-days after receipt of Notice to Proceed.

1.07 MEASUREMENT AND PAYMENT ITEMS

A. *Only those bid items included in the Bid Schedule are applicable for this Contract.*

Table A

BID ITEM	MEASUREMENT AND PAYMENT ITEMS
	Pg 1
	GENERAL REQUIREMENTS
	Reference ID 1.0 Mobilization and Demobilization (not to exceed 5% of the total of all bid items except bid items under section General)
	a. Measurement: Measurement of various items for Mobilization and Demobilization shall not be made for payment and all items shall be included in the lump sum price. <u>This lump sum price shall not exceed 5% of the total of all bid items except bid items under section 10.1 General.</u>

	b. Payment: Payment of 75 percent of the applicable lump sum price for the item shall be full compensation for the Work consisting of the preparatory Work and operations in mobilizing for beginning Work on the Contract, including, but not limited to, movement of those personnel, equipment, supplies and incidentals to the project site, preparation of submittals, and for the establishment of temporary tent, security fencing, safety equipment and first aid supplies, project signs, field surveys, sanitary and other facilities required by these specifications, and State and local laws and regulations. The costs of General Requirements (Section 01001) and General Conditions, bonds, and any required insurance, project signs, and any other preconstruction expense necessary for the start of the work, excluding the cost of construction materials, shall also be included. This Work also consist of the general project management of the Work including, but not limited to, field supervision and office management, as well as other incidental cost for management of the Work during the duration of the Contract. This Work also includes maintenance of the field offices for the duration of the Contract. c. Payment of the remaining 25 percent of the applicable lump sum price for this item also consists of demobilization or the operations normally involved in ending Work on the project including, but not limited to, termination and removal of temporary utility service and field offices; demolition and removal of temporary structures and facilities; restoration of Contractor storage areas; disposal of trash and rubbish, and any other post-construction work necessary for the proper conclusion of the Work.
	Reference ID 2.0 Field Survey, Record Drawings, Start-up and Commissioning, and Final Clean-up
	a. Measurement: Measurement will be based on a lump sum basis for construction of a completion of a layout survey, record drawings, mechanical equipment start-up of the temporary and permanent stations, and commissioning, and clean- up. b. Payment: Payment shall be made in accordance with the progress schedule and schedule of values based on actual work completed as determined by the Owner. Upon completion of this Bid Item, payment will be made at 100 percent of the lump sum price, less retained amounts.
	SITE WORK
	Reference ID 3.0 Erosion and Sediment Control
	a. Measurement: Measurement shall be based on satisfactory Erosion and Sediment Control in accordance with the Owner requirements and specifications (Section 01560). b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, materials, and equipment to control and prevent sediment transportation from the Work

	area to adjacent properties, including installation, maintenance, and removal of temporary erosion and sediment controls.
	Reference ID 4.0 Temporary Vacuum Station
	a. Measurement: Measurement for this item shall be based on percent complete of the installation of the Temporary Vacuum Station. b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, equipment and materials for hardware and equipment including receiving, handling, storage and installation of the pre-fabricated vacuum pump skids including the collection tank, sewage pumps, vacuum pumps, control panel, sump valve, and exhaust piping, along with all associated SS, DIP, and PVC piping, exhaust and vacuum hoses, fittings, valves, painting, and appurtenances, cleanup, and removal from site to Selma Drive district headquarters, and all other work not included in other bid items and incidental to completion of the vacuum pump station. Payment shall be based on percent complete of the contract lump sum price. The vacuum equipment package required for the system has been pre-determined by the Engineer and will be paid for by EWD in a separate contract with the vendor.
	Reference ID 5.0 Temp Slab
	a. Measurement: Measurement for this item shall be based on percent complete of the slab. b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, equipment and materials for concrete work and reinforcing, clean-up, and all other work not included in other bid items and incidental to completion of the vacuum pump station. Payment shall be based on percent complete of the contract lump sum price.
	Reference ID 6.x Pipelines: Force Mains, Vacuum Mains with Fittings, Kanaflex, and Exhaust hose
	a. Measurement: Pipeline installation regardless of material type and size shall be measured in actual linear feet satisfactorily furnished and installed, as measured along the length of the centerline of the completed pipeline, without deduction for the length of valves and fittings. Pipe included within the limits of lump sum pay items will not be measured for payment under this item. b. Payment: Payment will be made at the contract unit price bid per linear feet as stated in the proposal for pipeline with Fittings and shall include all labor, materials, and equipment to construct the respective pipeline including coordination with existing utilities, protection of existing utilities including service connections, tree protection, all necessary excavation (including rock), restraining of power poles as required, sheeting, shoring and bracing,

	dewatering, groundwater treatment and disposal, backfill, compaction, and grading, all testing, flushing, restoration, sod and clean-up. This item also includes all necessary non ductile iron fittings including reducers, bends, wyes, plugs, caps, and metallic tracer wire, line locator, identification markers, and removal and replacement of fences and gates, mailboxes, trees, shrubs, irrigation sprinklers and other obstructions.
	Reference ID 7.0 Ductile Iron Fittings (Various Sizes)
	a. DIP Fittings shall be measured per pound of Ductile Iron Fittings satisfactorily furnished and installed. b. The payment for work shall include, but not be limited to, furnishing all materials, labor, and equipment required to install fittings and solid sleeves as shown on the drawings, including excavation, disposal of excess materials, bracing, sheeting, dewatering, bolts, nuts, gaskets, flanges, mechanical joint restraints, backfill, testing, disinfection, layout, and any other items required for a complete and functional system. The number of glands, gaskets, nuts, washers, bolts, restraints and other accessories will not be measured for payment.
	Reference ID 8.x Gate Valve with Box (various sizes)
	a. Measurement: Measurement for Gate Valve with Box shall be made per actual number of gate valves with valve boxes satisfactorily furnished and installed complete with covers, cleanouts, and concrete collars. b. Payment: Payment for the Gate Valve with Box shall be made based on the authorized quantity at the unit price indicated in the Bid. Payment of the applicable Contract unit price shall be full compensation for furnishing all labor, materials and equipment to install the valve, valve box, valve box extensions, operating nut extensions, test station box and cap, valve wrenches, restraining devices, covers, concrete collars, excavation, sheeting, shoring, bracing, dewatering, backfill, compaction, restoration, and all other items required for a complete, acceptable and operable installation.
	Reference ID 9.0 Vacuum Cleanout Assemblies
	a. Measurement: Measurement for Vacuum Cleanout shall be made per actual number of sanitary sewer cleanouts satisfactorily installed. b. Payment: Payment shall be made based on the authorized quantity at the unit price indicated in the Bid. Payment of the applicable Contract unit price shall be full compensation for furnishing all labor, materials and equipment necessary to install the sanitary sewer cleanout including excavation, backfill, compaction and grading, all pipe, wyes, bends, sleeves, cam-loks, boxes, restoration and clean-up.
	Reference ID 10.0 Pump Station Civil Site Work
	a. Measurement: Measurement for this item shall be based on percent complete of the work.

	b. Payment: This item shall include all civil site work on the new pump station site including, tree protection and removal, clearing and grubbing, earth work and final grading for the site, sodding (bahia), concrete driveway and walkway, elliptical reinforced concrete pipe, water service relocation, and miscellaneous yard piping and site concrete work. Work shall be paid for on a lump sum percent complete basis for the individual components listed under this pay item in the approved Schedule of Values. Note: sewage force main and vacuum main will be paid for separately. All other site/yard piping that does not have a pay item shall be included in this item.
	Reference ID 11.0 Mulch Bed and Valve Pit
	a. Measurement: Measurement for this item shall be based on percent complete of the Mulch Bed. b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, equipment and materials for a complete mulch bed, piping inside mulch bed, stone, fabric, liner, exhaust manifold blow off assembly, exhaust piping from building to mulch bed and necessary connections. butterfly valve, installation only of the supplied vacuum valve pit and associated equipment for the mulch bed testing, cleanup, and all other work not included in other bid items and incidental to completion of the vacuum pump station mulch bed system as shown on the Contract Documents.
	PUMP STATION BUILDING
	Reference ID 12.0 Pump Station Building
	a. Measurement: Measurement for this item shall be based on percent complete of the work. b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, equipment and materials for all work associated with the vacuum sewer pump station building, waterproofing, termite control, concrete work, masonry, trusses, roofing, doors and hardware, louvers, structural steel, floor grating, stairs, drains, doors, windows, shutters, louvers, bridge crane, hoist and trolley, hangers, misc. fans, switches, grates, handrail, concrete deck, signage, and air conditioning unit, framing and drywall along with the excavation, dewatering, backfill, compaction, stucco, painting/coatings, crack repair, plumbing, sinks, clean-up, and all other work not included in other bid items and incidental to completion of the vacuum pump station. This item does not include vacuum sewer equipment and piping housed within the building. Work shall be paid for on a lump sum percent complete basis for the individual components listed under this pay item in the approved Schedule of Values.
	Reference ID 13.0 Vacuum Station Equipment
	a. Measurement: Measurement for this item shall be based on percent complete

	of the work. b. Payment: Payment of the applicable Contract lump sum price as stated in the proposal will be full compensation for furnishing all labor, equipment and materials within the new pump station including, receiving, handling, installation of the pre-fabricated vacuum pump skids including the collection tank, sewage pumps, vacuum pumps, control panel, sump valve, gauges, and exhaust piping, along with all associated stainless steel, ductile iron pipe and PVC piping, fittings, valves, painting, and appurtenances, cleanup, and all other work not included in other bid items and incidental to completion of the vacuum pump station. Work shall be paid for on a lump sum percent complete basis for the individual components listed under this pay item in the approved Schedule of Values. The vacuum equipment package required for the system has been pre-determined by the Engineer and will be paid for by EWD in a separate contract with the vendor.
	Reference ID 14.0 Project Electrical and Instrumentation Work
	a. Measurement: Measurement for this item shall be based on percent complete of the work. b. Payment: This item shall include all work described on the Electrical Drawings and Division 16 (other than the main control panel), including all temporary construction electrical work, electrical hardware, electrical connection from FP&L service to the station, connect to existing generator, automatic transfer switch, and instruments. Work shall be paid for on a lump sum percent complete basis for the individual components listed under this pay item in the approved Schedule of Values. The data flow telemetry system required for the system has been pre-determined by the Engineer and will be paid for by EWD in a separate contract with the vendor.
	Permit Allowance - This allowance is a fixed amount as noted on the bid form, is reserved to pay for any required permit fees, and shall be paid for as a reimbursement as described in the Contract Terms and Conditions.
	Owner's Allowance - This allowance is a fixed amount as noted on the bid form, is reserved to pay for unforeseen conditions as approved by the District, and shall be paid for as described in the Contract Terms and Conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01027
APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENT

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. Prior to submitting a monthly payment application, the Contractor's progressive As-Built Drawings for the period covered by the monthly payment application shall be submitted and accepted by the OWNER.

1.02 FORMAT

- A. Format and Content: Use the accepted Schedule of Values.
 - 1. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
 - a. Generic name
 - b. Related specification section
 - c. Name of subcontractor
 - d. Name of manufacturer or fabricator
 - e. Name of supplier
 - f. Dollar value
 - 2. Round amounts off to the nearest whole dollar. The total shall equal the Contract Amount.

1.03 PREPARATION OF APPLICATION

- A. Each Application for Payment shall be consistent with previous applications for payments as certified and paid for by the OWNER.
- B. Payment Application Times: As stated in the General Conditions, Payment Applications shall be submitted monthly on a day of the month established by the OWNER at the Pre-Construction Conference.
- C. Application Preparation: Contractor shall complete every entry on the Pay Application form. The form shall be executed by a person authorized to sign legal documents on behalf of the Contractor and the signature notarized. Incomplete applications will be returned without action. The following procedure shall be followed by the Contractor:
 - 1. Submit applications typed on forms provided by the OWNER.
 - 2. Use data on Bid Form and approved Schedule of Values. Provide dollar value in each column for each line item for portion of Work performed.
 - 3. List each authorized Change Order and use additional sheets if necessary, list Change

- Order number and dollar amount for the original item of work.
4. Each item shall have an assigned dollar value for the current pay period and a cumulative value for the project to-date.
 5. Submit stored material log, partial waivers of claims and mechanic liens, and Consent of Surety with each application, as further explained below.
- D. Contractor shall submit a stored material log with each application for payment that identifies the type, quantity, and value of all stored material that tracks when the stored materials were installed and deducts the installed material from the stored quantity at that time. Include original invoices for all stored materials for which payment is requested.
- E. Waivers of Claims and Mechanics Lien (Waivers): With each Application for Payment the Contractor shall submit waivers of claims and mechanic liens from Subcontractors, Sub-subcontractors, and suppliers for the construction period covered by the previous application.
1. The Contractor shall submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 2. When an application shows completion of an item, the Contractor shall submit final or full waivers.
 3. The Contractor shall submit the final Application for Payment with, if not already submitted, the final waivers from every entity involved with performance of work covered by the Application that could lawfully be entitled to a payment claim or lien.
 4. Format of Waiver Forms: The Contractor shall submit executed waivers of claims and liens on forms acceptable to the OWNER.
 5. The OWNER reserves the right to designate which entities involved in the Work must submit waivers.
- F. Transmittal of Pay Applications: Contractor shall submit one (1) electronic executed copies of the Application for Payment to the OWNER and all waivers of lien and similar attachments.
1. The Contractor shall transmit each Pay Application package with a transmittal form that lists attachments and all appropriate information related to the application. The transmittal form shall be acceptable to the OWNER.
 2. The Contractor shall include a certification with each application stating that all previous payments received from the OWNER under the Contract have been applied by the Contractor to discharge, in full, all obligations of the Contractor in connection with the Work covered by prior applications for payment. The Contractor shall also certify that all materials and equipment incorporated into the Work are free and clear of all liens, claims, security interest, and encumbrances.
- G. Initial Application for Payment Submittal: Administrative actions and submittals that must precede or coincide with submittal of the initial Application for Payment include the following:
1. List of Subcontractors
 2. List of principal suppliers and fabricators
 3. Schedule of Values
 4. Contractor's Construction Progress Schedule (accepted)
 5. List of Contractor's staff assignments

6. Copies of building permits
 7. Copies of authorizations and licenses from governing authorities for performance of the Work
 8. Certificates of insurance and insurance policies
 9. Performance and Payment bonds (if required)
 10. Data needed to acquire OWNER's insurance
- H. Monthly Application for Partial Payment Submittals: Administrative actions and submittals that must precede or coincide with submittal of Monthly Applications for Partial Payment include the following, as applicable:
1. Relevant tests
 2. Field Data (Copies of Field Books)
 3. Progressive As-builts Drawings (one (1) paper copy and electronic copy)
 4. Point file data
 5. An electronic copy of all survey field notes
 6. Partial Release of Lien
 7. Partial Consent of Surety
 8. Site photographs
 9. Updated Progress Schedule: submit one (1) electronic copy and five (5) copies
 10. Summary of Values
 11. Pay Request
 12. On-Site Storage of materials
- I. Substantial Completion Application for Payment Submittal: Following issuance of the Certificate of Substantial Completion, Contractor shall submit an Application for Payment. This Application shall reflect any Certificates of Partial Substantial Completion issued previously for the OWNER's occupancy of designated portions of the Work.
1. Administrative actions and submittals that shall precede or coincide with this application include:
 - a. Occupancy permits and similar approvals
 - b. Warranties (guarantees) and maintenance agreements
 - c. Test/adjust/balance records
 - d. Maintenance instructions
 - e. Meter readings
 - f. Start-up performance reports
 - g. Change-over information related to the OWNER's occupancy, use, operation and maintenance
 - h. Final Cleaning
 - i. Application for reduction of retainage and consent of surety
 - j. Advice on shifting insurance coverage
 - k. List of incomplete Work, recognized as exceptions to OWNER's Certificate of Substantial Completion
- J. Final Completion Application for Payment Submittal: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:

1. Prior to submitting a request for final payment or the OWNER issuing a Certificate of Completion for the Work, the Contractor shall submit the final Record Documents to the OWNER for approval. Retainage funds will be withheld at the OWNER's discretion based on the quality and accuracy of the final Record Documents.
2. Written signed statements by the Contractor
 - a. Completion of project close-out requirements
 - b. Completion of items specified for completion after Substantial Completion
 - c. Assurance that unsettled claims are settled
 - d. Assurance that work not complete and accepted is now completed
3. Transmittal of Record Documents to the OWNER
4. Proof that taxes, fees, and similar obligations have been paid
5. Removal of temporary facilities and services has been completed
6. Removal of surplus materials, rubbish, and similar elements
7. Prepare Application for Final Payment as required in General Conditions

1.04 PAY APPLICATION SUBSTANTIATING DATA

- A. When the OWNER requires substantiating data for a Pay Application, submit data justifying Pay Application line item amounts in question.
- B. Provide one (1) copy of data with a transmittal letter for each copy of Pay Application submittal. The Pay Application number, date, and line item by number and description shall be clearly stated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Contractor participation in pre-construction conferences, progress meetings and specially called meetings.

1.02 MEETINGS CALLED BY THE OWNER

- A. The OWNER will schedule and administer a pre-construction conference and specific topic meetings throughout the progress of the Work. The OWNER will:
 - 1. Prepare and distribute a notification of the meeting to required attendees.
 - 2. Establish, prepare and distribute an agenda with the notification.
 - 3. Make physical arrangements for the meetings.
 - 4. Preside at meetings.
 - 5. Prepare and distribute minutes of meetings including significant proceedings and decisions, within 15 working days after each meeting. Minutes will be forwarded to all participants and to parties affected by decisions made at the meeting.
- B. Representatives of the Contractor, Subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
- C. The meeting location will generally be a central site, convenient for all parties, designated by the OWNER.
- D. All meetings shall be digitally recorded with files provided to all requesting parties.

1.03 PRE-CONSTRUCTION CONFERENCE

- A. Attendance:
 - 1. OWNER
 - 2. Contractor and superintendent
 - 3. Subcontractors as appropriate to the agenda
 - 4. Representatives of suppliers and manufacturers as appropriate to the agenda
 - 5. OWNER representative
 - 6. Other agency representatives (FDEP, EPA, County, etc.)
 - 7. Surveyor
 - 8. Others as requested by the OWNER or Contractor

B. Suggested Agenda:

1. Distribution and discussion of:
 - a. List of major Subcontractors and suppliers
 - b. Construction schedules
 - c. Contact information
2. Organizational arrangement of Contractor's forces and personnel, and those of Subcontractors, material and equipment suppliers, and the OWNER
3. Critical work sequencing
4. Major equipment deliveries
5. Project coordination
 - a. Designation of responsible personnel
 - b. Channels and procedures for communication
6. Procedures and processing of:
 - a. Field decisions
 - b. Proposal requests
 - c. Submittals
 - d. Change orders
 - e. Applications for payment/Schedule of Values
 - f. Contractor quality control
 - g. Submittal of Shop Drawings, project data and samples
7. Adequacy of distribution of Contract Documents
8. Procedures for maintaining as built and record documents
9. Use of premises:
 - a. Office, work and storage areas
 - b. OWNER's requirements
 - c. Housekeeping
10. Temporary construction facilities
11. Temporary utilities
12. Safety and first aid procedures
13. Rules and regulations
14. Security procedures
15. Place, date and time for regular progress meetings
16. Completion time for Contract and liquidated damages

1.04 MEETINGS CALLED BY THE CONTRACTOR

- A. The CONTRACTOR will schedule and administer progress meetings throughout the progress of the Work. The CONTRACTOR will:
1. Prepare and distribute a notification of the meeting to required attendees.
 2. Establish, prepare and distribute an agenda with the notification.
 3. Make physical arrangements for the meetings.
 4. Preside at meetings.
 5. Prepare and distribute minutes of meetings including significant proceedings and decisions, within 15 working days after each meeting. Minutes will be forwarded to all participants and to parties affected by decisions made at the meeting.
- B. The meeting location will generally be a central site, convenient for all parties,

designated by the OWNER.

1.05 PROGRESS MEETINGS

- A. Meeting Frequency and Format: The CONTRACTOR shall schedule progress meetings at least once per month as required by progress of the Work with the first meeting approximately one (1) month after the pre-construction meeting or more frequently as warranted by the complexity of the Project, to review the Work, discuss changes in schedules, maintain coordination and resolve potential problems.
- B. Attendance:
 - 1. OWNER
 - 2. Contractor
 - 3. Subcontractors as appropriate to the agenda
 - 4. Suppliers as appropriate to the agenda
 - 5. Others as appropriate
- C. The Contractor's representative is to attend the project meetings and have the authority to act on behalf of the entity represented on field related matters. Contractor's representative is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics and provide specific information including but not limited to:
 - 1. Status of submittals and actions necessary to expedite them
 - 2. Status of activities behind schedule and actions necessary to regain the approved schedule
 - 3. Status of materials and equipment deliveries and action necessary to expedite materials and equipment and maintain the approved schedule
 - 4. Status of open RFI's and actions necessary to address them
- D. To the maximum extent practicable, the Contractor is to assign the same personnel to represent the Contractor at Progress Meetings throughout the progress of the work.
- E. The Contractor is to provide a current Shop Drawing submittal log at each progress meeting.
- F. The Contractor is to provide copies of the updated Progress Schedule at each project meeting in accordance with the General Conditions including a 3 week look ahead schedule for upcoming events.
- G. The Agenda and Minutes of the meeting will be maintained by CONTRACTOR and reviewed by OWNER prior to distribution by the CONTRACTOR. Distribute reviewed minutes to attendees within 7 calendar days after each meeting.
 - 1. Suggested Agenda:
 - a. Review and approve minutes from previous meeting
 - b. Review of work progress since previous meeting to include current As-Builts
 - c. Contractor's/Subcontractor's workforce and equipment
 - d. Progressive As-Built Drawings
 - e. Surveyor's submittals

- f. Field observations, problems and conflicts
 - g. Construction progress and problems which impede construction schedule
 - h. Shop Drawing submittal status
 - i. Requests for Information (RFI) status
 - j. Change Order status
 - k. Review of off site fabrication and delivery schedules
 - l. Corrective measures and procedures to regain approved schedule
 - m. Revisions to construction schedule
 - n. Job progress and schedule for succeeding work period
 - o. Coordination of schedules
 - p. Maintenance of quality standards
 - q. Review submittal schedule; expedite as required
 - r. Pending requests for information, changes and substitutions
 - s. Review proposed changes for effect on construction schedule and completion date
 - t. Pay application status
 - u. Other business
2. Revision to Minutes:
- a. Unless minutes are challenged, in writing, prior to the next regularly scheduled Progress Meeting, they will be accepted as properly summarizing the discussions and decisions of the meeting.
 - b. Persons challenging minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
 - c. Challenge to minutes shall be settled as priority portion of "old business" at next regularly scheduled meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION MEETING (NOT USED)

3.02 CONSTRUCTION PROGRESS MEETINGS

- A. Contractor shall provide the following:
- 1. Progressive As-Built Drawings
 - 2. Surveyor submittals
 - 3. Construction Contract, As-Built Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents
 - 4. Specifications and Addenda: Record manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed as well as any changes made by Field Order, Change Order or other
 - 5. Change orders, verbal orders, and other modifications to Contract
 - 6. Written instructions by the OWNER as well as correspondence related to Requests for Information (RFIs).
 - 7. Accepted Shop Drawings, samples, product data, substitution and "or-equal" requests.

8. Field test records, inspection certificates, manufacturer certificates and construction photographs.

END OF SECTION

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SECTION 012600 - MODIFICATION PROCEDURES

1.1 GENERAL

- A. Minor Changes in the Work: The Engineer will initiate and issue instructions authorizing minor changes in the Work.
- B. Owner-Initiated Change Order Proposal Requests: The Engineer will initiate and issue a description of proposed changes in the Work that require adjustment to the Contract Sum or Time. The description may include supplemental or revised Drawings and Specifications.
 - 1. Proposal requests are for information only. Do not consider them an instruction to stop work or to execute the proposed change.
 - 2. Within 10 days of receipt, submit an estimate of cost necessary to execute the change for the Owner's review.
 - a. Include an itemized list of products required and unit costs, with the total amount of purchases.
 - b. Indicate taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include an updated Contractor's construction schedule that indicates the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- C. Contractor-Initiated Proposals: When unforeseen conditions require modifications, the Contractor may submit a request for a change to the Engineer for review.
 - 1. Describe the proposed change. Indicate reasons for the change and the effect of the change on the Contract Sum and Time. If there is no change in Contract Sum and Time this will be a field change.
 - 2. Include an itemized list of products required and unit costs, with the total amount of purchases.
 - 3. Indicate taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 5. Only direct on-site costs shall be included in a proposal. Any Home Office, Supervision, Project Management, Site Superintendent, or similar costs are to be part of overhead costs.
- D. Construction Change Directive: When the Contractor disagrees on the terms of a Proposal Request, the Engineer may issue a Construction Change instructing the Contractor to proceed with a change.
 - 1. The Construction Change Directive contains a description of the change and designates the method to be followed to determine change in the Contract Sum or Time.
 - 2. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 3. After completing the change, submit an itemized account and supporting data to substantiate Contract adjustments.
- E. Change Order Procedures: Upon the Owner's approval of a Proposal Request, the Owner will issue a Change Order.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION (Not Applicable)

END OF SECTION 012600

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

Work completed without approved Shop Drawings and/or samples shall be considered installed at the Contractor's risk.

1.01 SHOP DRAWINGS AND DATA

- A. Shop Drawings defined in the General Conditions, shall complement design and construction Drawings, and shall contain sufficient detail to clearly define all aspects of the Construction. These Drawings shall be complete and detailed.
- B. Contractor and Supplier's catalog sheets, brochures, diagrams, illustrations and other standard descriptive data shall be clearly marked with specification title and numbers to identify pertinent materials, product or models. Delete information which is not applicable to the Work by striking or cross-hatching.
- C. If Shop Drawings 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. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, the Contractor shall not be relieved of the responsibility for executing the Work in accordance with the Contract, even though such Drawings have been reviewed.
- D. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog data sheets, cuts, performance curves, diagrams, verification of conformance with applicable standards or codes, materials of construction and similar descriptive material. Materials and equipment list shall, for each item, give the name and location of the Supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.
- E. For all equipment furnished, the Contractor shall provide a list including the equipment name and address and telephone number of the Supplier's representative and service company so that service and/or spare parts can be readily obtained.
- F. The Contractor will obtain an installation list from suppliers and equipment suppliers who propose to furnish equipment or products for submittal to OWNER/Professional along with the required Shop Drawings. The installation list shall include at least 5 installations where identical equipment has been installed and has been in operation for a period of at least 1-year.

1.02 REVIEW OF SHOP DRAWINGS AND SAMPLES

- A. The OWNER /Professional's review of Shop Drawings, Data, and Samples as submitted by the Contractor will be to determine if the items(s) generally conform(s) to the information in the Contract Documents and is/are compatible with the design concept. The OWNER/Professional's review and exceptions, if any, will not constitute an approval of dimensions, connections, quantities, and details of the material, equipment, device, or item shown.
- B. The review of drawings and schedules will be general, and shall not be construed:
 - 1. As permitting any departure from the Contract Documents
 - 2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials
 - 3. As approving departures from details furnished by the OWNER/Professional, except as otherwise provided herein
- C. If the drawings or schedules as submitted describe variations and show a departure from the Contract Documents which the OWNER/Professional 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, the OWNER/Professional may return the reviewed drawings without noting an exception.
- D. "Approved As Noted": Contractor shall incorporate OWNER/Professional's comments into the submittal before release to manufacturer. The Contractor shall send a letter to the OWNER/Professional acknowledging the comments and their incorporation into the Shop Drawing.
- E. "Amend and Resubmit": Contractor shall resubmit the Shop Drawing to the OWNER/Professional. The resubmittal shall incorporate the OWNER/Professional's comments highlighted on the Shop Drawing.
- F. "Rejected": Contractor shall correct, revise and resubmit Shop Drawing for review by OWNER/Professional.
- G. Resubmittals will be handled in the same manner as first submittals. For resubmittals the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by OWNER/Professional on previous submissions. The Contractor shall make any corrections required by the OWNER/Professional.
- H. If the Contractor considers any correction indicated on the Drawings to constitute a change to the Drawings or Specifications, the Contractor shall give written notice thereof to the OWNER/Professional.

- I. When the Shop Drawings have been completed to the satisfaction of the OWNER/Professional, the Contractor shall carry out the Construction in accordance therewith and shall make no further changes therein except upon written instructions from the OWNER/Professional.
- J. No partial submittals will be reviewed. Submittals not deemed complete will be stamped "Rejected" and returned to the Contractor for resubmittal. Unless otherwise specifically permitted by the OWNER/Professional, make all submittals in groups containing all associated items for:
 - 1. Systems
 - 2. Processes
 - 3. As indicated in specific Specifications SectionsAll drawings, schematics, manufacturer's product data, certifications, and other Shop Drawing submittals required by a system specification shall be submitted at one time as a package to facilitate interfaces checking.
- K. Only the OWNER/Professional shall utilize the color "red" in marking Shop Drawing submittals.
- L. Failure to comply with any of the above may result in the rejection of Shop Drawings.

1.03 PRODUCT DATA

- A. Submit not less than 4-copies, and a digital media copy that is approved by the OWNER/Professional. Mark each copy to identify applicable products, models, options and other data. Supplement manufacturers' standard data to provide information unique to the Work.

1.04 MANUFACTURERS' INSTRUCTIONS

- A. When required in an individual Specification Section, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing, in quantities specified for product data.

1.05 SAMPLES

- A. Submit full range of manufacturers' standard colors, textures and patterns for the OWNER's selection. Submit samples for selection of finishes within 30-days after Award of Contract. All color and finish selections must be submitted by the Contractor in a single submission, properly labeled and identified.
- B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.

- C. Submit the number of samples specified in the respective Specification section, but no less than two (2). After review one (1) will be retained by the OWNER. Reviewed samples that may be used in the Work are indicated in the Specification Section.
- D. Samples shall be delivered to the OWNER as directed. The Contractor shall prepay shipping charges on samples. Materials or equipment for which samples are required shall not be used in the Work until approved by the OWNER/Professional.
- E. Samples shall be of sufficient size to clearly illustrate:
 - 1. Functional characteristics of the product, with integrally related parts and attachment devices
 - 2. Full range of color, texture and pattern
 - 3. Each sample shall have a label indicating:
 - a. Name of Project
 - b. Name of Contractor and Subcontractor
 - c. Material or equipment represented
 - d. Place of origin
 - e. Name of product and brand (if any)
 - f. Location in Project
 - g. Specification title and number
 - h. Submittal number
 - i. Note: Samples of finished materials shall have additional marking that will identify them under the finished schedules.
- F. The Contractor shall prepare a transmittal letter, in triplicate (3) for each shipment of samples containing the information required in paragraph herein. The Contractor shall enclose a copy of this letter with the shipment and send a copy of this letter to the OWNER/Professional. 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.
- G. Approved samples not destroyed in testing shall be sent to the OWNER or stored at the site of the Work. Approved samples of the hardware in good condition may be incorporated in the Work if requested in writing by the Contractor and approved in writing by the OWNER/Professional. Samples that failed testing or were not approved will be returned to the Contractor at the Contractor's expense, if so requested at time of submission.

1.06 FIELD SAMPLES

- A. Provide field samples of finishes as required by individual Specifications sections. Install the sample completely and finished. Acceptable samples in place may be retained in completed Work.

1.07 DRAWINGS, PRODUCT DATA AND CERTIFICATES

- A. Each letter of transmittal shall identify each and every item transmitted by title, drawing

number, revision number and date.

- B. The OWNER generally will not check dimensions, quantities or schedules, except in cases where the information is lacking in the Specifications.
- C. The following is applicable to submitted drawings, data and certificates:
 - 1. Show relation to adjacent structures or materials.
 - 2. Clearly identify field dimensions.
 - 3. Show required dimensions and clearances.
 - 4. Performance characteristic and capabilities shall accompany original Shop Drawing submittals.
 - 5. Wiring diagrams and controls shall accompany original Shop Drawing submittals.
 - 6. Installation instructions shall accompany original Shop Drawing submittals.
 - 7. Each submittal shall identify applicable Standards, such as ASTM number or Federal Specification number.
 - 8. All information not pertinent shall be removed from the submittal, or shall be crossed out.
- D. When resubmission is required, the OWNER/Professional will return only two (2) marked up copies. A third submission from the same manufacturer will not be accepted.

1.08 SUBSTITUTIONS

- A. Refer to Section 01301 Product Substitutions.

1.09 AVAILABILITY OF SPECIFIED ITEMS

- A. Verify prior to bidding that all specified items will be available in time for installation during Construction for orderly and timely progress of the Work.
- B. In the event that specified items will not be available, notify the OWNER/Professional prior to receipt of proposals.

1.10 OPERATING MANUALS

- A. Submit all manuals in accordance with requirements of Divisions 2 through 16 of the Contract Specifications and Section 01700 "Project Closeout."

1.11 WARRANTIES, GUARANTEES AND BONDS

- A. Provide as required by Technical Sections of the Specifications and Sections 01700 "Project Closeout"

1.12 CADD FILES

- A. The Professional's CADD files will be available on a limited basis to qualified firms at the OWNER's prerogative. The procedure for requesting such files is noted elsewhere in

these documents and there is a cost associated with handling and reproduction. Recipients are cautioned that these files may not accurately show actual conditions as constructed. Users are responsible to verify actual field conditions.

- B. The Professional's Drawings are to be used only for background information. If the Professional's Drawings are just reproduced and resubmitted (e.g. for ductwork drawings) they will be rejected.
- C. Copies of data furnished by the OWNER/Professional to Contractor or Contractor to OWNER/Professional that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- D. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60-days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.
- E. When transferring documents in electronic media format, the transferring party makes no representations as to long-term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

1.13 PROJECT RECORD DOCUMENTS

Project Record Documents shall be submitted in accordance with Section 01720 "Project Record Documents" of these specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SUBMITTAL PROCEDURES

- A. Shop Drawing Submittal Schedule: Within 20-days after the Award of the Contract or before the Pre-Construction meeting, the Contractor shall submit to the OWNER/Professional a complete schedule of Shop Drawings submittals, for approval, with the respective dates for submission, the beginning of manufacture, testing and installation of materials, supplies and equipment, noting those submittals critical to the progress schedule and applicable building permits.
- B. Building Permit Material Shop Drawings: Within 30-days after the Notice to Proceed, the

Contractor shall submit to the OWNER/Professional all items for which Shop Drawings are to be submitted and approved prior to Building permits application and issuance. The contractor is responsible for all structural, component and cladding shop drawing submittals and approvals prior to applying for the building permit and affidavits milestone. These shop drawings must include all Florida Product Approvals for the building permit application process.

- C. Submittal Log: An accurate updated log of submittals will be maintained by the Contractor and subject to review by the OWNER/Professional at each scheduled progress meeting.
- D. If the Contractor considers any correction indicated on the Drawings to constitute a change to the Contract Drawings or specifications, the Contractor shall give written notice thereof to the OWNER/Professional. This does not constitute a change order until accepted by the OWNER.
- E. Shop Drawing and submittal data shall be reviewed by the OWNER/Professional for each original submittal and first resubmittal; thereafter review time for subsequent resubmittals shall be charged to the Contractor. The Contractor shall reimburse the OWNER for services rendered by the OWNER/Professional at the rate multiplied by the OWNER's Professional multiplier based on the fee schedule provided to the OWNER for this Project. If a OWNER engineer is performing any portion of the review, this fee is based upon the hourly rate of the engineer times the OWNER's multiplier for overhead, benefits, and expenses. The Contractor agrees that the OWNER shall deduct such charges from the Contract Amount by a deductive Change Order.
- F. Contractor Shop Drawing and Sample submittals shall include 4 copies in addition to any other copies that the Contractor wants returned. The OWNER will retain 4 copies of approved submittals.
- G. Identify Project, Project Number, date, dates of previous submittals, Contractor, Sub-Contractors, suppliers with their addresses, pertinent Drawings by sheet and detail number, and Specification Section number, as appropriate. Identify all deviations from the Contract Documents. Provide space for Contractor and Professional review stamps.
- H. Contractor's delivery of Shop Drawings for review shall follow a reasonable sequence, as is necessary to support the dates on the Progress Schedule and avoid an overload of Shop Drawings awaiting review at any one time. Coordinate submittal of related items.
- I. Submit Shop Drawings per the schedule of Shop Drawing submittals, inserted in 1 loose-leaf binder, with tabs and index to the OWNER/Professional. All individual submittal sheets inserted in said binder must be clearly marked and referenced to proper paragraph and subparagraph of specifications. Cross out any items on sheets which constitute information not pertaining to equipment specified. Clearly mark all components that are provided as "optional" by manufacturer. Shop Drawings shall be approved by the Contractor prior to submittal to the OWNER/Professional. Shop Drawings will be reviewed by the OWNER/Professional. After OWNER/Professional approval, reproduce and distribute in accordance with requirements herein.

- J. All submissions of Shop Drawings, brochures and catalog cuts shall be accompanied by a transmittal letter listing the Drawings submitted by number and title.
- K. When engineering calculations and/or professional certification of performance criteria of materials, systems, and/or equipment are required, the OWNER is entitled to rely upon the accuracy and completeness of such calculations and certifications submitted by the Contractor. Calculations, when required, shall be submitted in a neat, clear and in an easy to follow format. Such calculations and/or certifications shall be signed and sealed by a Professional Engineer registered in the State of Florida.
- L. Distribute copies of reviewed submittals to concerned parties. Instruct recipients to promptly report any inability to comply with provisions.
- M. Prior to submission of Shop Drawings and samples, the Contractor shall stamp and sign the submittals. Any submission which, upon examination by the OWNER, shows evidence of not having been thoroughly checked, or is not in compliance with the provisions of this Section will be returned to the Contractor for completion before it will be considered for review.
- N. Notify the OWNER of the need for making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the material or equipment Contractor proposes to supply.
- O. On resubmittals, direct specific attention in writing or on the revised Drawings or sample to revisions other than the corrections required by OWNER on previous submissions.
- P. All drawings, schematics, manufacturer's product data, certifications and other drawing submittals required for a system specification shall be submitted at one time as a package to facilitate interface checking.
- Q. All Shop Drawings shall be accompanied with a transmittal letter providing the following information:
 - 1. Project Title and Contract Number
 - 2. Date
 - 3. Contractor's name and address
 - 4. The number of each Shop Drawing, project data, and sample required
 - 5. Notification of Deviations from Contract Documents
 - 6. Submittal Log Number conforming to specification section numbers
 - a. Submit each specification section separately.
 - b. Identify each Shop Drawing item required under respective specification section.
 - c. Identify resubmittal using specification section followed by A (first resubmittal), B (second resubmittal)...etc.

3.02 CONTRACTOR'S REVIEW

- A. Contractor's Responsibility for Coordination: Where the dimension, size, shape, location, capacity or other characteristic affects another item, and where the Contractor selects, fabricates or installs related or adjacent products to be used, the Contractor shall be

responsible for coordination of related items. The Contractor shall insure that a proper exchange of information takes place prior to or during preparation of each submittal and that submittals reflect such coordination. The notation "verify" or "coordinate" on the Drawings indicates the necessity for Contractor coordination in the particular instances used.

- B. Contractor's Checking: When checking submittals from Subcontractors and suppliers, the Contractor shall mark all sets, indicating his corrections and comments in blue or green. Copies marked in red may be returned for revision.
- C. The Contractor is responsible to deliver and pick-up all submittals in a timely manner at the OWNER/Professional's designated office. The Contractor is responsible for all related costs and expenses for the transmittal of such submittals.

3.03 OWNER'S / PROFESSIONAL'S REVIEW

- A. Corrections or comments made on Shop Drawings during review do not relieve the Contractor from compliance with the requirements of Drawings and Specifications. This check is only for review of general conformance with the design concept of this Project and general compliance with information given in Contract Documents. Any substitutions or changes shall be properly noted.
- B. No action will be taken on "rough-in" Shop Drawings for plumbing and electrical connections when the items of equipment are not included in the same submittal.
- C. Review Time:
 - 1. On a normal basis, each submittal will be returned to the Contractor within 15 working days of the date it is received. Some submittals may require additional time.
 - 2. If, for any reason, the above schedule cannot be met, the Contractor will be so informed within a reasonable period and the Schedule of Submittals revised. If the specific submittal affects the critical path, the Contractor shall immediately notify the OWNER/Professional in writing. In the event of separate submittals of individual components of a system, these submittals may be held until all components of the system are submitted, and the Contractor will be so notified.

3.04 SHOP DRAWING SUBMITTAL SCHEDULE EXAMPLE

- A. The Contractor shall prepare a shop drawing submittal schedule for the project containing the information required in example provided herein. Note: Specific submittal items included in the example are not necessarily required and are to be used for reference information only.

LEGEND

PACK Submittal Package **SAM** Samples
SD Shop Drawings **QCS** Quality Control Submittal
PD Product Data **CCS** Contract Closeout

[illegible]

01300 - 10 of 10

SECTION 01310

PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

- A. At the Pre-Construction meeting, whichever occurs first, the Contractor shall prepare and submit to the Owner the estimated construction/progress schedule, in calendar days, based on the work items scheduled and sub-schedules of related activities essential to the progress of the Work.
- B. Contractor shall submit revised progress schedules on a monthly basis. No partial payments shall be approved by the Owner until there is an updated and approved construction progress schedule on file.
- C. The Contractor shall designate an authorized representative of the Contractor who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the Contractor shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the commitments of the Construction/Progress schedule.
- D. The progress schedule shall demonstrate complete fulfillment of the Contract Document requirements utilizing a Critical Path Method (CPM) precedence method to coordinate, plan, schedule, and perform the Work (including the activities of Subcontractors and suppliers) within the Contract Times or authorized extensions.

1.02 FORM OF SCHEDULE

- A. Prepare schedules in the form of a horizontal barchart.
 - 1) Provide a separate horizontal bar for each activity of each work item. Work items shall, at a minimum correlate to the Schedule of Values work items. Activities shall further break down the work items into smaller components, as approved by the Owner.
 - 2) Horizontal time scale: In weeks from start of construction and identify the first work day of each month. The schedule shall identify the day, month, and year of starting and finishing each activity.
 - 3) Scale and spacing: Scale to fit on sheet size provided, and sufficient space provided for notations and future revisions.
 - 4) Sheet size: 11" X 17".
- B. Format: Provide a chronological order of the start and finish of each work item and each activity under each work item.

1.03 CONTENT OF SCHEDULE

- A. Show the complete sequence of construction by activity including: Activity beginning and ending date; Activity duration; Early start date; Early finish date; Late start date; Late finish date; Float time for each activity, Total float time; and Predecessor and Successor relationships. **NOTE: Float is not time for the exclusive use or benefit of either the Owner or the Contractor. Extensions of time for performance may be granted by the Owner only to the extent that equitable time adjustments for the activity or activities affected exceed the total float.**
- B. Show the dates for the beginning of and completion of each element of Construction in no more than a one-week increment scale, including but not limited to:

- 1) Submittals schedule and review timelines
 - 2) Mobilization
 - 3) Individual Work Items as defined by the Contract Documents
 - 4) Activities under each Work Item
 - 5) Equipment and materials delivery of long lead items
 - 6) Substantial Completion Milestone
 - 7) Final Completion Milestone
 - 8) Other Milestones as required by the Contract Documents
- C. Show projected percentage of completion for each item, as of the progress schedule revision date (date of regular payment application).
- D. Show projected dollar cash flow requirements for each month of construction updated as of the date of regular payment application.
- 1.04 PROGRESS REVISIONS
- A. Indicate progress of each activity as of the date of the progress schedule revision, while maintaining the original approved (baseline) schedule. Show actual start and finish dates, and actual milestone dates on the progress schedule.
- B. Show changes occurring since the previous revision of progress schedule:
- 1) Major changes in scope.
 - 2) Activities modified since previous revision.
 - 3) Revised projections of progress and completion.
 - 4) Other identifiable changes.
- C. Provide a narrative report as needed to define:
- 1) Problem areas, anticipated delays, and the impact on the schedule.
 - 2) Corrective action recommended and its effect.
 - 3) The effect of changes on schedules of other prime contractor(s) and others.
- 1.05 SUBMISSIONS
- A. Submit initial schedule to the Owner at the Pre-Construction meeting.
- 1) The Owner will review schedule and return it to the Contractor for revisions, if required.
 - 2) The Contractor shall resubmit a revised schedule within 7 days after return of review copy, if required.
 - 3) Submit two (2) electronic copies and two (2) hard copies of the approved initial progress schedule, and each approved monthly update thereof, to the Owner.
- B. Submit revised monthly progress schedules with each month's application for payment. **A payment application will not be considered for payment unless it is accompanied by an updated and approved progress schedule.**
- 1.06 DISTRIBUTION
- A. Distribute copies of the approved schedule to:
- 1) The Owner (two (2) electronic copies, two (2) hard copies)
 - 2) Subcontractors and Suppliers as needed
- B. Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedules.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01370
SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DEFINITION

- A. Schedule of Values: Schedule that divides the Contract Amount into pay items, such that the sum of all pay items equals the Contract Amount for the Work, or for any portion of the Work having a separate specified Contract Amount.

1.02 REQUIREMENT

- A. The Schedule of Values established as provided in this section serves as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to the OWNER. Progress payments on account of Unit Price Work will be based on the number of units completed and shall be prorated by the percent complete on the number of units installed not meeting all requirements of the Contract including testing.
- B. No payment will be made for Work performed on a lump sum contract or a lump sum item until the appropriate Schedule of Values is approved by the OWNER.
- C. The equitable value of Work deleted from a lump sum contract or lump sum item shall be determined from the approved Schedule of Values.

1.03 SUBMITTALS

- A. Submit digital media copies of a Preliminary Schedule of Values within 15-days after the recommended award of the Contract.
- B. Submit digital media copies of a proposed final Schedule of Values within 20-days after receipt of Notice to Proceed.
- C. Submit the Schedule of Values, typed, on OWNER forms or spreadsheets provided by OWNER. The Contractor's standard form or electronic media printout will be considered for acceptability by the OWNER.
- D. List installed value of each major item of Work and each subcontracted item of Work as a separate line item to serve as a basis for computing values for Progress Payments. Round off values to nearest dollar.
- E. Coordinate listings with the Progress Schedule.
- F. For items on which payments will be requested for stored materials or equipment, list sub-values for cost of stored products with taxes paid and provide corresponding schedule of value item number. Stored materials quantities shall not exceed installed quantities on bid tab or as required by the Contract Documents.

- G. Submit a sub-schedule for each separate stage of Work specified in Section 01010 "Summary of Work."
- H. The sum of values listed shall equal the total Contract Amount for the Work or the Contract Amount for a part of the Work with a separate Contract Amount provided for by the Contract Documents.
- I. When the OWNER requires substantiating information, submit data justifying line item amounts in question.

1.04 UNIT PRICE CONTRACTS

- A. For unit price contracts, the bid item prices on the Project Bid Schedule shall be used as the basis for the schedule of values. The Contractor shall resubmit the bid item prices in the format described herein, and may, at its option, or if requested by the OWNER, divide the items in the Project Bid Schedule into sub-items to provide a more detailed basis of payment.

1.05 LUMP SUM CONTRACTS (NOT USED)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.01 SITE INVESTIGATION AND CONTROL

- A. Contractor shall verify all dimensions in the field and check field conditions continuously during construction. Contractor shall be solely responsible for any inaccuracies built into the Work due to Contractor's failure to comply with this requirement.
- B. Contractor shall inspect related and appurtenant Work and report in writing to OWNER any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor at Contractor's sole cost and expense.

1.02 INSPECTION OF THE WORK

- A. The Work shall be conducted under the general observation of representatives of the OWNER acting on behalf of the OWNER to ensure strict compliance with the requirements of the Contract Documents. Such inspection may include mill, plant, shop, or field inspection, as required. The OWNER shall be permitted access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated. Inspection by the OWNER are in addition to the inspections required of Contractor by his QC Representatives.
- B. The presence of the OWNER, however, shall not relieve the Contractor of the responsibility for the proper execution of the Work in accordance with all requirements of the Contract Documents. Compliance is a duty of the Contractor, and said duty shall not be avoided by any act or omission on the part of the OWNER. Further, no requirement of this Contract may be waived or modified except by change order or formal (written) substitution approval.
- C. All materials and articles furnished by the Contractor shall be subject to rigid inspection, and no materials or articles shall be used in the Work until they have been inspected and accepted by the OWNER. No Work shall be backfilled, buried, cast in concrete, hidden, or otherwise covered until it has been inspected. Any Work so covered in the absence of inspection shall be subject to uncovering. Where uninspected Work cannot be uncovered, such as in concrete cast over reinforcing steel, all such Work shall be subject to demolition, removal, and reconstruction under proper inspection and no additional payment will be allowed therefore.

- D. The Contractor is responsible for the Quality of his own work and shall designate a qualified individual, to be approved by the OWNER, who will ensure that all work is performed in strict accordance with the Contract Documents. This quality representative shall inspect the work for the Contractor and provide to the OWNER and the Contractor a report outlining all work accomplished, all inspections, and all testing performed for all days when work is performed. The objective of this report is to provide "Objective Evidence of Compliance" by the Contractor with the requirements of the Contract.

1.03 TIME OF INSPECTION AND TESTS

- A. Samples and testing required under these Specifications shall be furnished and prepared in ample time for the completion of the necessary tests and analyses before said articles or materials are to be used. Except as otherwise provided in the Contract Documents, performance of the required tests will be by the Contractor and all costs therefore will be borne by the Contractor at no cost to the OWNER. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any Work under this Contract, the OWNER shall be notified not less than 24-hours in advance to request inspection before beginning any such Work of covering. Failure of the Contractor to notify the OWNER at least 24-hours in advance of any such inspections shall be reasonable cause for the OWNER to order a sufficient delay in the Contractor's schedule to allow time for such inspection, any remedial, or corrective work required, and all costs of such delays, including its impact on other portions of the Work, shall be borne by the Contractor.

1.04 SAMPLING AND TESTING

- A. When not otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered. However, the OWNER reserves the right to use any generally accepted system of inspection which, in the opinion of the OWNER, will ensure the OWNER that the quality of the workmanship is in full accord with the Contract Documents.
- B. Any waiver of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any technical or qualitative requirements of the Contract Documents.
- C. Notwithstanding the existence of such waiver, the OWNER shall reserve the right to make independent investigations and tests as specified in the following paragraph and, upon failure of any portion of the Work to meet any of the qualitative requirements of the Contract Documents, shall be reasonable cause for the OWNER to require the removal or correction and reconstruction of any such Work.

- D. In addition to any other inspection or quality assurance provisions that may be specified, the OWNER shall have the right to independently select, test, and analyze, at the expense of the OWNER, additional test specimens of any or all of the materials to be used. Results of such tests and analyses shall be considered along with the tests or analyses made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed provided that wherever any portion of the Work is discovered, as a result of such independent testing or investigation by the OWNER which fails to meet the requirements of the Contract Documents, all costs of such independent inspection and investigation and all costs of removal, correction, reconstruction, or repair of any such Work shall be borne by the Contractor.

1.05 RIGHT OF REJECTION

- A. The OWNER shall have the right at all times and places to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the site. If the OWNER or inspector, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such material, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected by OWNER.
- B. Contractor shall promptly remove rejected articles or materials from the site of the Work after notification or rejection.
- C. All costs of removal and replacement of rejected articles or materials, as specified herein, shall be borne by the Contractor.
- D. If the Contractor fails to remove or replace defective work after notification to do so, the OWNER may have the work removed and replaced by others and deduct all costs from the Contractor's pay requests.

1.06 TESTING LABS

- A. All geotechnical testing laboratory services for field testing will be paid by the Contractor. The lab(s) shall function as independent lab(s) and report independently to the OWNER and the Contractor. The test lab(s) may not approve or allow any deviation from the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01410
TESTING AND TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work:
 - 1. The Contractor will employ and pay for services of an Independent Testing Laboratory to perform Testing specifically indicated on the Contract Documents or specified in the Specifications and may at any other time elect to have materials and equipment tested for conformity with the Contract Documents at the direction of the Engineer of Record.
 - 2. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.
 - 3. Employment of laboratory by Contractor shall in no way relieve Contractor's obligations to perform the Work.
- B. Related Requirements Described Elsewhere:
 - 1. Conditions of the Contract.
 - 2. Respective section of Specifications: Certification of products.
 - 3. Each Specification section listed: Laboratory tests required and standards for testing.

1.02 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with OWNER's personnel; provide access to work and manufacturer's operations.
- B. Secure and deliver to the OWNER adequate representational samples of materials proposed to be used and which require testing.
- C. Provide to the OWNER the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.
- D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. The OWNER may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the OWNER shall be allowed on account of such testing and certification.
- E. All testing shall be coordinated through the Contractor.

F. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the Project site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

G. Notify OWNER sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. The following field testing schedule summarizes the responsibilities of various tests that may be required by the Contract Documents

TEST	NOTES	PAID FOR
Soil Compaction	A. Pipe Work: Every 300 ft. at each lift of compaction B. Structures: As a minimum one test per 2000 SF of fill area per lift, or at least 2 tests per structure, per lift. As specified in material specifications sections	Contractor
Low Pressure Air Exfiltration	Each section of gravity sewer pipe between manholes or lift station	Contractor
Hydrostatic Pressure	All segments of pressure piping (24-hour test).	Contractor
Hydrostatic Leakage	All segments of pressure piping (2-hour test).	Contractor
Bacteriological	As required by local and state agencies	Contractor
Asphaltic Concrete Paving	As required by OWNER	Contractor
LBR	Each 600 SY of pavement	Contractor
Concrete	Slump test each delivery, cylinders every 20 CY	Contractor
Asbestos	Environmental testing of materials	Contractor
All Other Testing	As specified in various sections of the Technical Specifications	As Indicated

H. The OWNER can employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the OWNER's convenience.

I. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the Contractor shall pay for the laboratory costs directly to the OWNER or the total costs shall be deducted from any payments due to the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01590
TEMPORARY FACILITIES AND TENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Contractor provision of temporary utilities to include electricity, lighting, internet connectivity, cooling, ventilation, water, and sanitary facilities.
- B. Contractor provision of temporary controls to include barriers, enclosures and fencing, and water control.
- C. Contractor provision of temporary facilities to include access roads, parking, and temporary buildings.
- D. Contractor provision of field offices for the District's and Contractor.
- E. Restrictions on the use of existing adjacent facilities.

1.02 TEMPORARY ELECTRICITY

- A. Provide and pay for power service required for Construction and testing from local utility source.
- B. Provide temporary electric feeder from existing electrical service at location as directed by utility company. Power consumption will not disrupt the District's need for continuous service. Coordinate with the District before making taps or disturbing existing service.
- C. Provide separate metering and pay for cost of energy used until substantial completion.
- D. Provide power outlets for Construction operations, with branch wiring and distribution boxes located as required. Provide OSHA approved flexible power cords as required.
- E. Contractor-installed permanent convenience receptacles may be used during Construction.

1.03 TEMPORARY LIGHTING

- A. Provide and maintain two (2) foot-candle lighting to exterior staging and storage areas after dark for security purposes.
- B. Provide and maintain 0.25-watt/sq ft H.I.D. lighting to interior Work areas after dark for security purposes.
- C. Provide branch wiring from power source to distribution boxes with lighting conductors,

pigtails, and lamps as required.

D. Maintain lighting and provide routine repairs.

E. Permanent building lighting may be used during Construction.

1.04 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.05 TEMPORARY WATER SERVICE

A. Provide, maintain, and pay for suitable quality water service required for Construction operations. Coordinate with the District if water supply is not separately metered. Pay all costs and expenses associated with such use.

B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.06 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures on-site. Maintain daily in clean and sanitary condition. Adjacent District building toilet facilities are not to be used by Contractor.

1.07 BARRIERS

A. Provide barriers to prevent unauthorized entry to Construction areas and to protect existing facilities and adjacent properties from damage from Construction operations.

B. Provide barricades required by governing authorities for public rights-of-way.

C. Provide protection for plant life designated to remain. Replace damaged plant life.

D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.08 SECURITY FENCING (VACUUM STATION AND LAYDOWN AREAS)

A. Unless directed otherwise in other sections of the Contract Documents, provide a 6-foot high fence completely around Construction site property as shown on the site plan; provided with hinged vehicular and pedestrian gates with locks. Fencing will be galvanized, 2-inch mesh, chain link with solid top rail. Provide line posts and end posts as needed to maintain stretched and uniform fencing with no sags.

B. Fencing plan will be approved by the County for each phase of the project. Submit fencing layout diagram prior to the Pre-Construction meeting.

- C. Provide visual fabric barrier at least 6-foot high on all fencing. Submit barrier fabric for approval before starting fencing. Barrier fabric will be capable of retaining physical integrity and color during the entire Construction period.

1.09 ACCESS ROADS (IF APPLICABLE)

- A. Provide and maintain uninterrupted public access to existing buildings. Construction activities will not interfere with access. If Contractor fails to maintain public access after 2 written notices within a 24-hour period, the District reserves the right to correct such situation and back charge the Contractor.
- B. Construct and maintain temporary roads accessing public thoroughfares to serve Construction area.
- C. Extend and relocate access roads as Work progress requires. Provide detours necessary for unimpeded traffic flow.
- D. Provide and maintain access to fire hydrants, free of obstructions.
- E. Designated existing on-site roads may be used for Construction traffic. Repair or restore any damaged areas caused as a result of Construction activity. Such repair will be to a like-new condition.

1.10 PARKING

- A. Provide temporary surface parking areas to accommodate Construction personnel.
- B. Do not allow Construction vehicle parking on existing pavement unless approved by District.

1.11 TEMPORARY TENT(S)

- A. Promptly after starting Work, the Contractor will provide and maintain a temporary frame type tent for the use of covering the temporary vacuum pump skids until Substantial Completion.
- B. The tent will be an appropriate size required for covering the equipment and an additional 6ft clearance on all sides of the equipment. The Contractor shall submit a schematic site plan showing the tent or tents layout for approval.
- C. Installation of the tent will meet all local codes and ordinances. The Contractor will as a minimum install the structures on a level, well-drained area.
- D. Anchorage required for all weather conditions.
- E. Exit opening shall remain open when occupied.
- F. No combustible materials (hay and Straw).

G. No flame devices inside or within 20 feet.

H. Provide Portable fire extinguisher 2A 10bc rating for each 75' travel.

1.12 REMOVAL OF TEMPORARY UTILITIES, FACILITIES, AND CONTROLS

- A. Remove all temporary utilities, equipment, facilities, and materials prior to submitting Final Application for Payment.
- B. Remove temporary underground installations to minimum depth of 2-feet and re-grade site.
- C. Clean and repair damage caused by installation or use of temporary Work.
- D. Restore any existing facilities used during Construction to original condition, unless otherwise directed in other sections of Contract Documents. Restore existing landscaping, drainage, paving, etc. to an "as-was" condition, unless otherwise directed in other sections of Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01610
DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section specifies the general requirements for the delivery, handling, storage and protection for all items required in the construction of the Work.
- B. Deliver, handle and store products in accordance with manufacturer's recommendations and by methods and means that will prevent damage, deterioration, and loss including theft and protect against damage from climatic conditions. Control delivery schedules to minimize long-term storage of products at the site and overcrowding of construction spaces. In particular, provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss. Damaged or defective items, in the opinion of the OWNER, will be replaced at no cost to the OWNER.

1.02 REQUIREMENTS

- A. The Contractor is responsible for all material, equipment and supplies sold and delivered to the OWNER under this Contract until final inspection of the Work and acceptance thereof by the OWNER.
- B. All materials and equipment to be incorporated in the Work will be handled and stored by the Contractor before, during and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.
- C. All materials and equipment, which in the opinion of the OWNER, have become so damaged as to be unfit for the use intended or specified, will be promptly removed from the site of the Work, and the Contractor will receive no compensation for the damaged materials or equipment or for its removal.
- D. In the event any such material, equipment and supplies are lost, stolen, damaged or destroyed prior to final inspection and acceptance, the Contractor will replace same without additional cost to the OWNER.

1.03 DELIVERY

- A. Transport and handle items in accordance with manufacturer's instructions.

- B. The OWNER and the Contractor's project superintendent must be on-site to accept all deliveries shipped directly to the job site. If the project superintendent is not present for a delivery, that delivery may be rejected by the OWNER. If any delivery is rejected due to non-availability of the Contractor's project superintendent, delivery shall be rescheduled at no additional cost to the OWNER.
- C. Schedule delivery to reduce long-term on-site storage prior to installation and/or operation. Under no circumstances will materials or equipment be delivered to the site more than 1-month prior to installation without written authorization from the OWNER.
- D. Coordinate deliveries in order to avoid delay in, or impediment of, the progress of the Work.
- E. Schedule deliveries to the site not more than 1-month prior to scheduled installation without written authorization from the OWNER.
- F. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
- G. All items delivered to the site will be unloaded and placed in a manner that will not hamper the Contractor's normal construction operation or those of Subcontractors and other Contractors and will not interfere with the flow of necessary traffic.
- H. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible. Maintain packaged materials with seals unbroken and labels intact until time of use.
- I. Immediately on delivery, inspect shipments with the OWNER to ensure compliance with requirements of Contract Documents and accepted submittals, and that products are properly protected and undamaged. If the Contractor does not notify the OWNER regarding the delivery and the OWNER rejects any part of the delivery, there will be no additional cost to the OWNER for the material to be returned. For items furnished by others (i.e. OWNER), perform inspection in the presence of the OWNER. Provide written notification to the OWNER of any problems.
- J. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the OWNER.

1.04 STORAGE AND HANDLING

- A. Provide equipment and personnel to handle products by methods recommended by the manufacturer to prevent soiling or damage to products or packaging, with seals and labels intact and legible.
- B. The Contractor is responsible for securing a location for on-site storage of all material and equipment necessary for completion of the Work. The location and storage layout will be submitted to the OWNER at the Pre-Construction conference.

- C. Manufacturer's storage instructions will be carefully studied by the Contractor and reviewed with the OWNER. These instructions will be carefully followed and a written record of this kept by the Contractor.
- D. All material delivered to the job site will be protected from dirt, dust, dampness, water, and any other condition detrimental to the life of the material from the date of delivery to the time of installation of the material and acceptance by the OWNER.
- E. When required or recommended by the manufacturer, the Contractor will furnish a covered, weather protected storage structure providing a clean, dry, non-corrosive environment for all mechanical equipment valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this Project.
- F. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.
- G. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within 7-days after written notice to do so has been given, the OWNER retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contract Amount. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.

1.05 SPECIFIC STORAGE AND HANDLING

(Additional specific storage and handling requirements may be found in the specification sections addressing the material requirements.)

- A. All mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) will be stored in a weather tight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the OWNER. The building will be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by manufacturer.
 - 1. All equipment will be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the manufacturer. Mechanical equipment to be used in the Work, if stored for longer than 90-days, will have the bearings cleaned, flushed and lubricated prior to testing and startup, at no extra cost to the OWNER.
 - 2. Moving parts will be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment, the Contractor will start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

3. Lubricants will be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants will be put into the equipment at the time of acceptance. Prior to acceptance of the equipment, the Contractor will have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer will be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment will be judged to be defective. It will be removed and replaced at the Contractor's expense.
 4. Electric motors provided with heaters will be temporarily wired for continuous heating during storage. Upon installation of the equipment, the Contractor will start the equipment, at least half load, and once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.
- B. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
 - C. Cement and lime will be stored under a roof and off the ground and will be kept completely dry at all times.
 - D. Brick, block and similar masonry products will be handled and stored in a manner to minimize breakage, chipping, cracking and spilling to a minimum.
 - E. Precast Concrete will be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking.
 - F. All structural and miscellaneous steel and reinforcing steel will be stored off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams will be stored with the webs vertical.
 - G. Metals will be stored dry, all under cover and vented to prevent build-up of humidity, all off ground to provide air circulation.
 - H. Lumber will be stacked to provide air circulation. Store materials for which maximum moisture content is specified in an area where moisture content can be maintained.
 - I. Gypsum wallboard systems will be stored to protect all metal studs, furring, insulation boards, batts, accessories and gypsum board to prevent any type of damage to these materials. Rusted material components, damp or wet insulation or gypsum boards will not be accepted.

- J. Acoustical materials will be delivered to the job site in unbroken containers labeled and clearly marked. Materials will not be removed from containers until ready to install, but will be stored in dry area with cartons neatly stacked. Before installation, acoustical board will be stored for not less than 24-hours in the Work area at the same temperature and relative humidity.
- K. Linear items will be stored in dry area with spacers to provide ventilation. Stack linear items to prevent warping, complying with manufacturer's instructions.
- L. Paints and other volatile materials will be stored within approved safety containers. No glass jugs will be permitted. Storage areas will be equipped with not less than 2 fire extinguishers (C02 type) sufficient to discharge a distance of 25-feet when fully charged and have current tags. No other building materials will be stored in this area. Used rags will be removed daily. Clean rags will be stored in metal closed containers.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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SECTION 01650
PUMP STATION START-UP AND TESTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor will conduct preliminary testing of pump station facilities, products and equipment. If the preliminary field tests disclose any items furnished under this Contract which do not comply with the requirements of the Contract Documents, the Contractor shall make all changes, adjustments and replacements required prior to Start-up Demonstration and Acceptance Testing.
- B. The Contractor shall arrange qualified instruction by the manufacturer's representative for the OWNER's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.
- C. The Contractor shall furnish all labor, fuel, energy, lubrication, water, and all other materials, equipment, tools and instruments necessary for the Start-up Demonstration and Acceptance Testing unless otherwise specified.
- D. The startup and final check out shall demonstrate and ensure to the OWNER the complete operating pump station system. The Contractor shall provide documentation certifying proper installation, testing and operation of all prescribed equipment and systems.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PUMP STATION START-UP TESTING AND INSPECTION

- A. The Contractor shall notify the OWNER at least 10 normal working days prior to start-up.
- B. The following shall have been successfully met prior to pump station start-up:
 - 1. A walk through letter of acceptance received
 - 2. All wire checks conducted
 - 3. FDEP Clearances received
 - 4. FDEP placard for fuel tank if applicable
 - 5. Certified Boundary Survey and As-Built Survey
 - 6. The Contractor shall conduct preliminary testing of equipment prior to start-up testing and make all changes, adjustments and replacements required; and Power is on and ready to go.

7. An operable force main is in place and operational.
 8. Water is available to flush the pipe lines.
 9. The standby generator is in place and operational
- C. The Contractor shall furnish all labor, fuel, energy, lubrication, water and all other materials, equipment, tools, and instruments necessary for pump station start-up testing and inspection. All required certification letters, spare parts and supplies shall be provided to the OWNER. Listed below is a partial checklist of requirements to be met.
1. All major equipment vendors – AirVAC, I&C contractor, Electrician, and Generator field tech shall be present to configure, troubleshoot and coordinate that all signals and parameters are available and fully functional. If not a Vendor will be REQUIRED to comeback at no additional cost to solve I/O signals or operational problems with the equipment. The intent of the start-up testing is for the Contractor to demonstrate to the OWNER that the Work will function as a complete and operable system under normal as well as emergency operating conditions and the pump station is ready for acceptance.
 2. The Contractor shall coordinate startup activities with the OWNER, the manufacturer's representatives and Subcontractors. A factory representative knowledgeable in the mechanical and electrical equipment furnished shall inspect and supervise a start-up of their respective equipment. A minimum of 1 full business day shall be provided for the testing. Additional time may be necessary due to faulty or incomplete Work. Upon satisfactory completion of the equipment testing and inspection, the factory representative(s) shall issue the required manufacturer's warranty certificates.
 3. Initiate start-up of each system in accordance with the operation and maintenance manual. Demonstrate that all of the components of a system are operating under their own controls as designated without overheating or overloading any parts and without objectionable vibration as determined by the OWNER.
 4. Observe the system operation and make adjustments as necessary to optimize the system performance. Coordinate with OWNER for any adjustments desired or operational problems requiring debugging.
 5. All functions of the pump station mechanical and electrical equipment shall be tested and inspected for operation and workmanship. All equipment shall be properly installed and meet the design performance requirements.
 6. The pumps shall be flow tested at the pump station start-up to verify their performance meets the design requirements and the manufacturer's pump curve.
 7. Furnish 2 printed copies and 3 electronic copies in Acrobat "pdf" format of the Operation and Maintenance Manual for the pump station to the OWNER.
 8. A pump station start-up report shall be completed. The Contractor shall bear the entire expense of rectifying Work installed.
 9. The Contractor shall furnish the OWNER with a written certification signed by the Manufacturer's representative that the equipment has been properly installed and lubricated, is in accurate alignment, is free from undue stress imposed by piping or mounting bolts, and has been operated under full load conditions and that satisfactory operation has been obtained.

D. Re-testing

If the start-up testing does not meet the requirements, the deficiencies shall be corrected and the testing procedure will be rescheduled again.

E. FDEP fuel tank placard

When a generator fuel tank is required, the Contractor shall submit documentation that the facility has passed the FDEP fuel tank compliance inspection and that a properly completed "Storage Tank Facility Registration Form" has been submitted to the Florida Departmental of Environmental Protection including all applicable fees. The placard shall be provided to the OWNER.

F. Acceptance

1. The pump station shall be accepted based on the pump station functioning as a complete and operable system under normal as well as emergency operating conditions, the approved construction documents have been met and any deficiencies that were observed and noted have been corrected.
2. The Contractor shall ensure all fuel, lubrication, and all other materials for operation are replenished.

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SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

The term "Project Closeout" is defined to include requirements near the end of the Contract Time, in preparation for Substantial Completion acceptance, occupancy by the OWNER, release of retainage, final acceptance, final payment, and similar actions evidencing completion of the Work. Time of closeout is directly related to "Substantial Completion"; therefore, the time of closeout may be either a single period for the entire Work or a series of time periods for individual elements of Work that has been certified as substantially complete at different dates. This time variation, if any, will be applicable to the other provisions of this section.

1.02 SCOPE OF WORK

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Final Cleaning
 - 2. Substantial Completion
 - 3. Final Acceptance

1.03 RELATED WORK

- A. Drawings and general provisions of the Contract, including General, Special, and Supplementary Provisions - Construction and other Division 1 Specification Sections, apply to this Section.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.
- C. Section 01720 "Project Record Documents"

1.04 PREREQUISITES FOR SUBSTANTIAL COMPLETION.

When the Contractor considers the Work as substantially complete, submit to the OWNER a written notice stating so and requesting an inspection to determine the status of completion. The Contractor will attach to the notice a list of items known to be incomplete or yet to be corrected. Complete the following before requesting the OWNER's inspection for certification of substantial completion.

- A. In the progress payment request that coincides with or is the first request following, the date substantial completion is claimed, show 100% completion or list incomplete items, the value of incomplete Work, and reasons for the Work being incomplete. Inspection procedures include supporting documentation for completion as indicated in these Contract Documents.
- B. Submit a statement showing an accounting of changes to the Contract Sum.
- C. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.
- D. Obtain and submit lien releases enabling the OWNER's full, unrestricted use of the Work and access to services and utilities.
- E. Consult with OWNER before submitting Record Documents in accordance with Section 01720 "Project Record Documents."
- F. Submit Operation and Maintenance Manuals.
- G. Make final changeover of permanent locks. Submit keys and keying schedule.
- H. Deliver tools, spare parts, extra stock, and similar items.
- I. Complete final cleaning requirements necessary for Substantial Completion.

1.05 FINAL CLEANING.

Complete the following cleaning operations prior to Substantial Completion or Owner occupancy.

- A. Remove from job site all tools, surplus materials, construction equipment, storage sheds, debris, waste and temporary services.
- B. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. Structures:
 - 1. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges and other foreign matter.
 - 2. Remove all traces of splashed materials from adjacent surfaces.
 - 3. Ensure exterior surfaces have a uniform degree of cleanliness.
 - 4. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges and other foreign matter.
 - 5. Remove paint droppings, spots, stains and dirt from finished surfaces.
 - 6. Remove labels that are not permanent labels.
 - 7. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - 8. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition,

- free of stains, films and similar foreign substances. Leave concrete floors broom clean.
9. Wipe surface of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.
 10. Clean permanent filters of ventilating systems and replace disposable filters if units were operated during construction. Clean ducts, blowers and coils if units were operated without filters during construction.

1.06 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor will submit the proposed format, content and tab structure for all Operating and Maintenance Manuals for the OWNER's review and approval. The tab structure for Operating and Maintenance Manuals will follow specification division format as accepted by the Construction Specification Institute. After the OWNER approves the proposed format, content, and tab structure for the Operating and Maintenance Manuals, the Contractor will create and deliver 5 complete sets.
- B. Operation and Maintenance documentation is required for each piece of mechanical, electrical, communications, instrumentation and controls, pneumatic, hydraulic, conveyance, and special construction. If required by the technical specifications, provide Operation and Maintenance documentation for any other product not listed in the foregoing.
- C. The requirements of this Section are separate, distinct and in addition to product submittal requirements that may be established by other Sections of the Specifications. Owner's manuals, manufacturer's printed instructions, parts lists, test data and other submittals required by other Sections of the Specifications may be included in the Operating and Maintenance Manuals provided that they are approved and are formatted in a manner consistent with the requirements of this Section.
- D. Deliver Operation and Maintenance Manuals directly to the OWNER.
- E. Operating and Maintenance Manual documents must include, but are not limited to, table of contents, approved submittals, manufacturer's operating and maintenance instructions, brochures, Shop Drawings, performance curves and data sheets annotated to indicate equipment actually furnished (e.g. identifying impeller size, model, horsepower, etc), procedures, wiring and control diagrams, records of factory and field tests and device/controller settings and calibration, program lists or data compact discs, maintenance and warranty terms and contact information, spare parts listings, inspection procedures, emergency instructions, and other Operating and Maintenance documentation that may be useful to the OWNER. The material and equipment data required by this Section must include all data necessary for the proper installation, removal, normal operation, emergency operation, startup, shutdown, maintenance, cleaning, adjustment, calibration, lubrication, assembly, disassembly, repair, inspection, trouble-shooting, and warranty service of the equipment or materials.
- F. The Contractor must bind the Operating and Maintenance Manual documents in heavy-

duty, 3-ring vinyl-covered binders including pocket folders for folded sheet information. Mark binder identification on both the front and spine of each binder. Binder information must list the project title, identify separate structures or locations as applicable, identify the general subject matter covered in the manual and must include the words "OPERATING AND MAINTENANCE INSTRUCTIONS".

1. The Contractor must submit the Operating and Maintenance documents on three-hole punched, 8-1/2-inch x 11-inch sheets or on three-hole punched sheets that are foldable in multiples of 8-1/2-inch x 11-inch. The three-hole punched edge will be the left 11-inch edge.
2. The Contractor may request waivers to the size requirement for specific instances. The Contractor's waiver request must be in writing to the OWNER. The Contractor's waiver request must include a justification for seeking the waiver.

G. The Contractor must provide an electronic version of the complete and final Operating and Maintenance Manuals in original electronic file format on compact disc or DVD. The Contractor must also provide one (1) electronic pdf file of each bound Operating and Maintenance Manual that represents each Manual's content. The electronic pdf file must match the Operating and Maintenance Manual content and organizational structure.

1.07 SUBSTANTIAL COMPLETION INSPECTION PROCEDURES

- A. Upon receipt of the Contractor's request for inspection, the OWNER will either proceed with inspection or advise the Contractor of incomplete prerequisites.
- B. Following the initial inspection, the OWNER will either prepare the certificate of Substantial Completion, or advise the Contractor of Work which must be performed before the certificate will be issued. The OWNER will repeat the inspection when requested in writing and when assured that the Work has been substantially completed.
- C. Results of the completed inspection will form the initial "punch list" for final acceptance.

1.08 PREREQUISITES FOR FINAL ACCEPTANCE.

Complete the following before requesting the OWNER's final inspection for certification of final acceptance, and final payment. List known exceptions, if any, in the request.

- A. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates for insurance for products and completed operations where required.
- B. Submit written certification that:
 1. The OWNER's final punch list of itemized Work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.
 2. The Contract Documents have been reviewed and Work has been completed in accordance with Contract Documents.

3. Equipment and systems have been tested in the presence of the OWNER and are operational.
4. Work is completed and ready for final inspection.

C. Submit consent of surety.

D. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

1.09 FINAL ACCEPTANCE INSPECTION PROCEDURES

- A. The OWNER will re-inspect the Work upon receipt of the Contractor's written notice that the Work, including punch list items resulting from earlier inspections, has been completed, except for those items for which completion has been delayed because of circumstances that are acceptable to the OWNER.
- B. Upon completion of re-inspection, the OWNER will either prepare a certificate of final acceptance or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled, which are required for final acceptance.
- C. If necessary, the re-inspection procedure will be repeated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The purpose of the Project Record Documents is to provide the OWNER with factual information regarding all aspects of the Work, both concealed and visible.

1.02 DEFINITIONS

- A. Boundary Survey: Boundary survey, map and report certified by a Surveyor shall be provided that meets the requirements of Chapter 5J-17 'Minimum Technical Standards', FAC.
- B. Surveyor: Contractor's Surveyor that is licensed by the State of Florida as a Professional Surveyor and Mapper pursuant to Chapter 472, F.S.

1.03 QUALITY ASSURANCE

- A. Delegate the responsibility for maintenance of the Record Documents to one person on the Contractor's staff as approved by the OWNER.
- B. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of specifications and each sheet of Drawings and other documents where such entry is required to show progress and changes properly.

1.04 RECORD DOCUMENTS AT SITE

- A. Maintain at the site and always available for OWNER's use one (1) record copy of:
 - 1. Construction Contract, Drawings, Specifications, General Provisions, Special Provisions, Supplemental Provisions - Construction, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents
 - 2. Change Orders, Verbal Orders, and other modifications to Contract
 - 3. Written instructions by the OWNER as well as correspondence related to Requests for Information (RFIs)
 - 4. Accepted Shop Drawings, Samples, product data, substitution and "or-equal" requests
 - 5. Field test records, inspection certificates, manufacturer certificates and construction photographs
 - 6. Field Data
 - 7. Paper copies of the Progressive As-Built Drawings
 - 8. Current Surveyor's tables for the point file data
- B. Maintain the documents in an organized, clean, dry, legible condition and protected from deterioration, loss and damage until completion of the Work, transfer of all record data to

the final As-built Drawings for submittal to the OWNER.

- C. Store As-Built Documents and samples in Contractor's office apart from documents used for construction. Do not use As-Built document for construction purposes. Label each document "AS-BUILT" in neat large printed letters. File documents and samples in accordance with CSI/CSC format.
- D. Record information concurrently with construction progress. Do not conceal any Work until required information is recorded.

PART 2 - PRODUCTS

2.01 FIELD DATA

- A. The Contractor shall maintain, during the progress of the project, accurate field data records. A set of field books will be kept by the Contractor for this purpose. Promptly after completion of any portion of the work provided, as paid for in this Contract, the Contractor shall deliver to the Engineer the field data books with accurate notations recorded thereon as necessary to revise the drawings for record purposes.
 - a. The Contractor shall maintain, during the progress of the project, accurate records of the location, running line lengths, slopes and elevation of all new and existing pipelines, vacuum sewer mains and vacuum sewer appurtenances.
 - b. As-built drawings shall include surveyed information (and swing-tie information as required). This does not relieve the Contractor from obtaining missed or incorrect information/data that is necessary for the production of the final record drawings.
 - c. Information to be shown in the field books for utility mains shall include, accurate installation information of the construction crew, location of work (streets, orientation, addresses, etc.), alignment, running line lengths, slopes and elevation of all utility and vacuum sewer mains and appurtenances, Vacuum Sewer Valve pit sketches, the location of all crosses, tees, wyes, bends, valves, curb stops, meter boxes, hydrants, stub-outs, blow-offs, air release valves, etc., by using a two (2) point swing measurement from permanent physical features that can readily be found on the drawing and in the field, in a table format. The Contractor shall furnish "as-built" top of pipe elevations and finish grade for top of trench for all utility mains at maximum intervals of one hundred feet (100') and at all utility crossings, at all fittings and valves and all changes in grade and pipe type. In addition, the Contractor shall reference all new utility mains by the distance to the right-of-way or property markers.
- B. Field data: Copies of Field Books containing valve pit, and main line pipe work data per the referenced examples referenced herein as well as the final valve pit drawings shall be submitted with each pay application, said pay application shall not be accepted until field data is deemed up-to-date by the Engineer of Record.

2.02 AS-BUILT SURVEY DRAWINGS

- A. The Contractor's surveyor is responsible for producing complete modified plan/profile design drawings for the purposes of as-built drawings. All point information, line work, objects, annotations provided on the design drawings shall be reproduced with the appropriate as-built data as applicable. The EOR will provide an AutoCAD drawing of the project to the contractor's Professional Licensed Surveyor in order to develop the complete modified as-built drawing. The Contractor and surveyor shall coordinate with the EOR during development of the as-built drawings and provide any additional field information necessary as requested by the EOR to complete the final record drawings. The EOR shall use the surveyor's as-built drawing and point file data in addition to the Contractor's and inspector's reports to review the final record drawings for the project.
- B. The Contractor and the Contractor's surveyor shall provide all information as indicated on specification sections 01720.1 and 01720.2 for minimum as-built drawing requirements.
- C. All proposed design layers must be frozen or screened/faded back.
- D. As-built survey drawings shall be submitted with each pay application, said pay application shall not be accepted until drawing is deemed acceptable and up-to-date by the Engineer of Record.
- E. Maintain the electronic As-Built Drawings to accurately record progress of Work and change orders throughout the duration of the Contract.
- F. Date all entries. Enter RFI No., Change Order No., etc. when applicable.
- G. Call attention to the entry by highlighting with a "cloud" drawn around the area affected or other means. In the event of overlapping changes, use different colors for entries of the overlapping changes.
- H. Design call-outs shall have a thin strike line through the design call-out and all As-Built information must be labeled (or abbreviated "AB") and be shown in a bolder text that is completely legible.
- I. Asbuilt entries shall consist of graphical representations, plan view and profiles, line work, written comments, dimensions, State Plane Coordinates, details and any other information as required to document field and other changes of the actual Work completed. As a minimum, make entries to also record:
 - 1. As-Built point file data shall be completed in the Drawings.
 - 2. Asbuilt Pipe: Actually installed pipe or other work materials, class, pressure-rating, diameter, size, specifications, etc. Similar information for other encountered underground utilities, not installed by Contractor, their owner and actual location if different than shown in the Contract Documents.
 - a. Reference attached examples and checklist sections 01720.1, 01720.2, for minimum as-built drawing requirements.
 - b. Information to be provided for vacuum sewer utilities projects shall include horizontal and vertical surveyed coordinates (point#, station, offset, and GPS coordinates: northing, easting, and elevation and revised slopes, description)

accurate to 0.05'. Items to be included in survey information shall include, but not be limited to, the location of all pipe, valve pits, buffer tanks, wyes, bends, valves, and other related improvements. Provide the following point format in the drawing views:

Plan view (Point#, Station, Offset, Northing, Easting, Elevation, and Description)

Profile view (Point#, Elevation)

- c. The Contractors surveyor shall furnish "as-built" top of pipe elevations, finished grade for top of trench, and distance to right-of-way or property lines for all pipes at maximum intervals of one hundred feet (100') and at all utility crossings, fittings and valves, elevation shot fifty (50) prior to a lift, and all changes in grade and pipe type.
 - d. The surveyor is responsible for calculating the running line lengths and slopes between points/features/fittings.
 - e. The profiles line work shall have dimensioned lengths and re-calculated slopes between events. Profiles must be redrawn to ensure the slope of the pipes are adequate.
 - f. The annotations in the plan and profile shall include point numbers.
 - g. For directional drilled utility mains, the "as-built" top of pipe elevations shall be recorded every rod length change and plotted on the plan and profile drawings sheets.
 - h. If required by the District, the surveyed data, major elements of the improvement shall be located on the Contractor's drawings by using a two (2) point swing measurement from permanent physical features that can readily be found on the drawing and in the field, in a table format. Major items shall be considered to be valves, meters, vaults, valve pits, buffer tanks and other items that comprise the critical elements of the constructed improvements. The contractor is responsible to verify this requirement.
 - i. The Contractor shall be held responsible for the accuracy of such data and shall bear any costs incurred in finding utilities as a result of incorrect data furnished by the Contractor.
 - j. Utility features described above shall be surveyed using conventional and GPS equipment at survey grade level. The recorded/blue booked GPS control monument, recorded benchmark elevation, and the vertical datum used shall be noted on the as-built drawings. Sub-foot GPS coordinates shall be based on the State Plane, Florida West 1983. Elevations shall be based on mean sea level 1988 NAVD.
3. Vacuum Sewer Valve Final pit installation sketches shall be created using field data for each valve pit installation on 8-1/2"x11" format paper bound. The drawing shall be accurate and include all data and follow the same format as referenced in sections 01720.3 and 01720.4 for minimum as-built drawing requirements.
 4. Depths of various elements of foundation in relation to finish floor datum and State Plane Coordinates and elevations.
 5. When electrical boxes, or underground conduits and plumbing are involved as part of the Work, record true elevations and locations, dimensions between boxes.
 6. Details, not on original Contract Drawings, as needed to show the actual location of the Work completed in a manner that allows the OWNER to find it in the future.

7. The Contractor shall mark all arrangements of conduits, circuits, piping, ducts and similar items shown schematically on the construction documents and show on the As-Built Drawings the actual horizontal and vertical alignments and locations.
8. Major architectural and structural changes including relocation of doors, windows, etc. Architectural schedule changes according to Contractor's records and Shop Drawings.

2.03 RECORD DOCUMENTS

- A. Three (3) paper copy sets and digital media of the following final Record Documents below.
 1. The following documents shall be signed and sealed by the Surveyor:
 - a. As-built survey drawings as previously described in paragraph 2.01 on full size 22"x34" format for Work related to constructing the project.
 - b. Boundary Survey on a 8 1/2"x11" format of fee simple and/or permanent easement sites for pump stations, treatment facilities, etc.. As a minimum the Boundary Survey shall show all above ground and underground structures or equipment, pipe, and conduit. All property or easement corners and the center of wetwell shall be shown with GPS coordinates. The Boundary Survey field work shall be dated after the Work has been completed.
 - c. Boundary Survey on an 8 1/2"x11" format for Work related to constructed pipes within any permanent easements. As a minimum the Boundary Survey shall show the location of the pipe centerline and property corners with GPS coordinates. The Boundary Survey field work shall be dated after the Work has been completed within the easements.
 - d. Vacuum Sewer Valve pit Final sketches on 8-1/2"x11" format bound in 3-ring binder for each vacuum valve pit installation. The drawing should include all work related to constructed sewer lateral pipes and fittings.
 2. Provide Scanned "As-Built" Drawing sets complete and include the title sheet, plan/profile sheets, cross-sections, and details. Each individual sheet contained in the printed set of the As-Built Drawings shall be included in the electronic drawings, with each sheet being converted into an individual tif (tagged image file). The plan sheets shall be scanned in tif format Group 4 at minimum of 400 dpi resolution to maintain legibility of each drawing. Then, the tif images shall be embedded into a single pdf (Adobe Acrobat) file representing the complete plan set.
 3. Provide Scanned Record Documents reflecting changes from the Contract Documents.
- B. Provide an encompassing digital AutoCAD file in the Engineer's current version required of AutoCAD and the file shall be saved under in the format dwg. The file includes all the information of the As-Built Survey and any other graphical information in the As-Built Drawings. It shall include the overall Work, utility system layout and associated parcel boundaries and easements. Feature point, line and polygon information for new or altered Work and all accompanying geodetic control and survey data shall be included. The Surveyor's point file data shall be added to the As-Built Drawings.
 1. All Record Drawing information shall accurately depict all surveyed information with all horizontal vector information being shown in the North American Datum of 1983

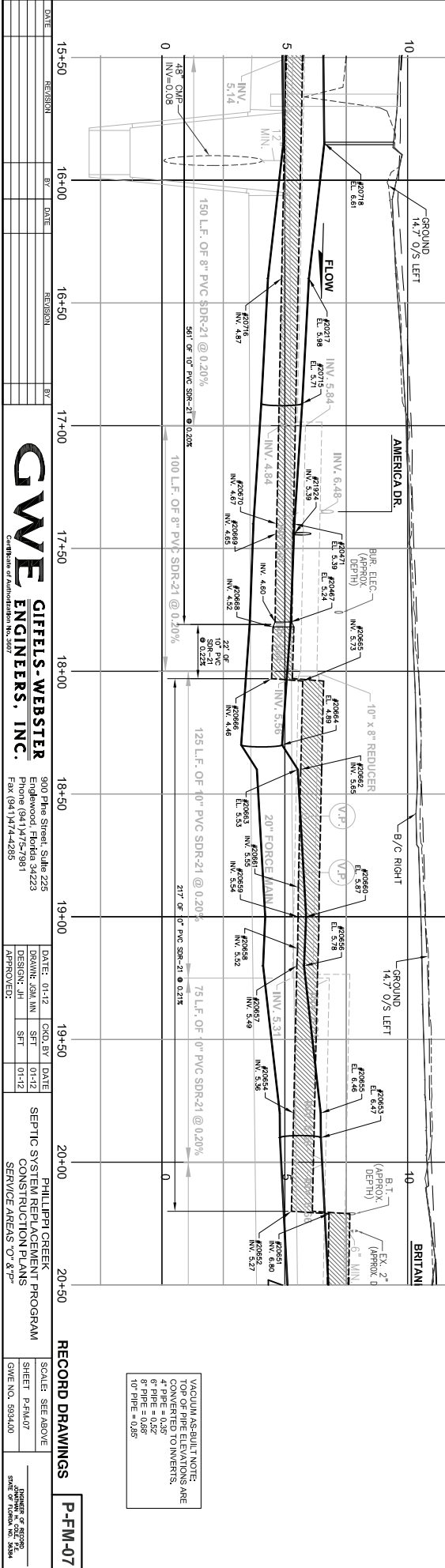
- (NAD83) and in the Florida East Zone State Plane Coordinate System or the latest NGS Adopted Datum using U.S. Survey Feet as the unit of measurement.
2. AutoCAD FILES: The digital Record Drawing AutoCAD file shall follow these general standards for inclusion in the Utility's Geographic Information System (GIS):
 - a. The surveyor shall prepare a single AutoCAD file of the as-built data. Any large aeriels or similar image files should be uploaded and all appropriate project x-ref files bound before saving the file. Do not use e-transmit to prepare the files as it creates multiple files.
 - b. All Record Drawing Piping information shall be placed on separate layers by piping type, diameter and material. All Record Drawing fixture information (fire hydrants, valves, meters, reducers, tees, wyes, crosses, caps, etc.) shall be placed on separate layers by the piping type they are attached to.
 - c. All piping shall be drafted as polylines; separated only at junctions or changes in pipe diameter.
 - d. All piping polylines shall snap to one another at every junction and change in pipe diameter.

PART 3 - EXECUTION

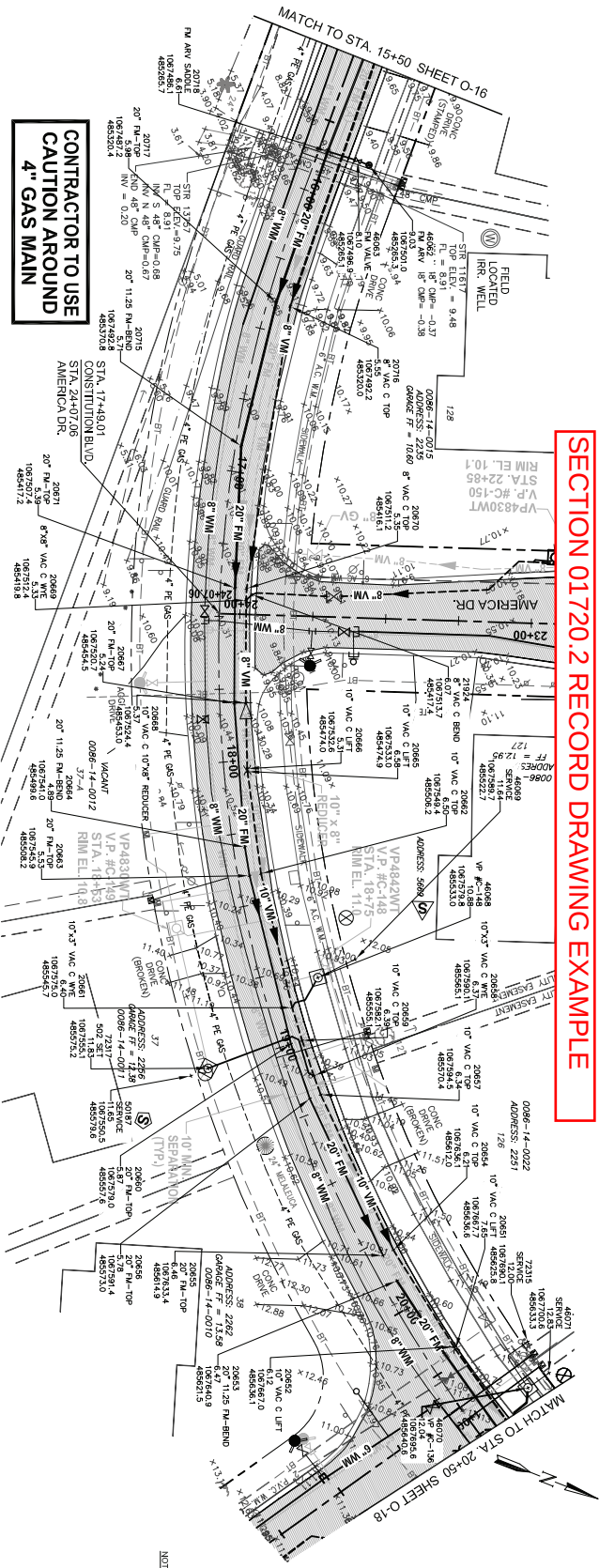
3.01 FINAL RECORD DOCUMENTS SUBMITTAL

- A. Submit the Final Record Documents within 20-days after Substantial Completion.
 1. Participate in review meetings as required and make required changes and promptly deliver the Final Record Documents to the OWNER.
- B. SUBMITTAL: Upon completion of the work, but prior to submittal of request for final payment or final acceptance, the contractor or developer's engineer shall obtain and submit record information certified by a Florida Professional Surveyor and Mapper. One PDF of the plan sheets, profiles, details and pump station shall be provided for initial review. The print shall be signed and sealed by the Florida Professional Surveyor and Mapper and the Florida Professional Engineer responsible for certifying the project. All sheets must include the vertical datum and horizontal datum used in easily readable print. Upon OWNER approval of the PDF file, electronic Record Drawing CAD files shall also be provided as follows:
 1. One (1) digital Record Drawing CAD file saved in the original format as designed, but being AutoCAD version 2010 - 2014.
 2. One (1) digital Record Drawing saved in PDF format as an exact reproduction of the signed and sealed Record Drawing on paper, without signature or seal with a resolution of 1200 dots per inch (DPI)

END OF SECTION



CONSTITUTION BLVD., STA. 15+50 - 20+00



SECTION 01720.2 RECORD DRAWING EXAMPLE

NOTE: ALL UNDERGROUND UTILITY LOCATIONS ARE APPROXIMATE BASED ON CURRENT INFORMATION.



SECTION 02140

DEWATERING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section specifies the furnishing of equipment; labor and materials necessary to remove storm or subsurface waters from excavation areas in accordance with the requirements set forth, as shown on the Drawings, and/or geotechnical report.

1.02 QUALITY ASSURANCE

- A. Qualifications: The Contractor shall engage a firm in the State of Florida, to design the temporary dewatering system. The Contractor shall submit conceptual plan for the dewatering system prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan. The dewatering system shall be designed by a firm who regularly engages in the design of dewatering systems and who is fully experienced, reputable and qualified in the design of such dewatering systems.
- B. The dewatering of any excavation areas and the disposal of the water shall be in strict accordance with the latest revision of all local and state government rules and regulations.
- C. Permits: The Contractor shall obtain and pay respective fees for all local, state, and federal permits (including the South Florida Water Management District discharge permits) required for the withdrawal, treatment and disposal/discharge of water from the dewatering operation, prior to start of work.
- D. Comply with Florida Administrative Code, Chapter 62-621.300 (2).

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the OWNER for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. In accordance with FAC 62-621.300(2), submit analytical test results from a certified laboratory for the parameters listed in the FDEP "Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity" to the FDEP and the OWNER. The submitted information shall show the location of the work, where the water will be going to, as well as an estimate for the amount, rate and duration of discharge being proposed.

- C. Provide notification to all jurisdictional permitting agencies in accordance with the requirements of the respective agency.
- D. Provide a detailed plan and operation schedule for dewatering of excavations.
 - 1. Provide descriptive literature of the dewatering system.
 - 2. Provide a plan for erosion and sedimentation control during dewatering.
 - 3. Provide copies of all permits/approvals for disposal/discharge of water during dewatering.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall have on-site and available the analytical test results performed in accordance with the FDEP "Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity" (FAC 62-621.300(2)).
- B. The Contractor shall provide adequate equipment for the removal of storm or subsurface waters which may accumulate within the excavation.
- C. The Contractor's attention is directed to the water surface elevations discussed in the report(s) on subsurface investigations. Water levels will normally vary from season to season.
- D. The Contractor shall be required to monitor the performance of the dewatering system during the progress of the Work and make such modifications as may be required to assure that the systems will perform satisfactorily. The dewatering system shall be designed in such a manner as to preserve the undisturbed bearing capacity of the sub-grade soils at the bottom of the trench or excavation.
- E. Prior to excavation, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions to the OWNER. Approval of the dewatering plan shall not relieve the Contractor of the responsibility for the satisfactory performance of the system. The Contractor shall be responsible for correcting any disturbance of natural bearing soils or damage to structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.
- F. If subsurface water is encountered, the Contractor shall utilize suitable equipment to adequately dewater the excavation. A wellpoint system or other OWNER acceptable dewatering method shall be utilized if necessary to maintain the excavation in a dry condition for preparation of the trench bottom and for pipe laying. Within and adjacent to residential areas and other areas as required by the OWNER, engines driving dewatering pumps shall be equipped with residential type mufflers and the noise shall not exceed 55 decibels within 50-feet.

3.02 DEWATERING AND DISPOSAL

- A. The Contractor shall construct and place all pipelines, structures, concrete work, structural fill, backfill and bedding material in-the-dry. In addition, the Contractor shall make the final 24-inches of excavation in-the-dry and not until the water level is a minimum of 2-foot below proposed bottom of excavation. For purposes of this Contract, in-the-dry is defined as $\pm 2\%$ of the optimum moisture content of the soil.
- B. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of all water entering excavations. Contractor shall keep excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
- C. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
- D. It is expected that dewatering will be required for pre-drainage of the soils prior to final excavation for most of the in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed so that the structure, pipeline or fill will not be floated or otherwise damaged.
- E. If wellpoints are used, Contractor shall adequately space wellpoints to maintain the necessary dewatering. Provide suitable filter sand and/or other means to prevent pumping of fine sands and silts. A continual check shall be maintained by the Contractor to ensure that the subsurface soil is not being removed by the dewatering operations. Pumping from wellpoints shall be continuous and standby pumps shall be provided.
- F. The Contractor's proposed method of dewatering shall include groundwater observation wells to determine the water level during construction. Observation wells shall be installed along pipelines as required to verify depth to water level and at locations approved by the OWNER.
- G. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from the surface shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped or drained by gravity to maintain an excavation bottom free from standing water.
- H. Flotation shall be prevented by the Contractor by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible for all damages which may result from failure to adequately keep excavations dewatered.
- I. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent properties or facilities. No water shall be discharged without appropriate treatment for adverse contaminants. No water shall be drained in work built or under construction without prior consent from the OWNER. Water shall be filtered to remove sand and fine soil particles before disposal into any drainage system.

- J. Dewatering of excavations shall be considered incidental to the construction of the Work and all costs shall be included in the various Contract prices in the Bid Form, unless a separate bid item has been established for dewatering.

3.03 GROUNDWATER TREATMENT (IF REQUIRED)

- A. If concentrations of tested groundwater quality parameters exceed those allowable in the FDEP Generic Permit for the Discharge of Produced Groundwater from any Non-Contaminated Site Activity (62-621.300(2), F.A.C.), the Contractor shall treat the effluent.
- B. The Contractor shall immediately notify the OWNER and discuss the parameters that exceed allowable limits.
- C. The Contractor shall meet with the FDEP to determine alternatives that are acceptable to the FDEP.
- D. The Contractor shall apply for and obtain any and all permits and/or treatment approvals that FDEP requires including but not limited to:
 - 1. Generic Permit for Discharges from Petroleum Contaminated Sites (62-621.300(1)). Allows discharges from sites with automotive gasoline, aviation gasoline, jet fuel, or diesel fuel contamination; or
 - 2. Permit for all Other Contaminated Sites (62-04; 62-302; 62-620 & 62-660). The coverage is available only through the individual NPDES permit issued by FDEP, allows discharges from sites with general contaminant issues i.e. ground water and/or soil contamination other than petroleum fuel contamination; or
 - 3. Generic Permit for the Discharge of Produced Ground Water from Any Non-Contaminated Site Activity (62-621.300(2), F.A.C.); or
 - 4. Generic Permit for Stormwater Discharge from Large or Small Construction Activities (62-621.300(4)(a), F.A.C.); or
 - 5. An Individual Wastewater Permit (62-604.300(8) (a))
- E. The Contractor shall implement the appropriate treatment that is acceptable to FDEP and OWNER to attain compliance for all excess limits encountered during dewatering activities. Treatment may include, but is not limited to: Chemical, Biological, Electrolysis or any combination of the three.
- F. The Contractor shall make every effort to minimize the spread of contamination into uncontaminated areas. Provide for the health and safety of all workers at the job site and make provisions necessary for the health and safety of the public that may be exposed to any potentially hazardous conditions. Ensure provision adhere to all applicable laws, rules or regulations covering hazardous conditions and will be in a manner commensurate with the level of severity of the conditions.
- G. If necessary, provide contamination assessment and remediation personnel to handle site assessment, determine the course of action necessary for site security and perform the necessary steps under applicable laws, rules and regulations for additional assessment and/or remediation work to resolve the contaminations issue.

- H. Delineate the contamination area(s) and any staging or holding area required and develop a work plan that will provide the schedule of projected completion dates for the final resolution of the contamination issue.
- I. Maintain jurisdiction over activities inside any delineated contamination areas and any associated staging or holding areas. Be responsible for the health and safety of workers within the delineated areas. Provide continuous access to representatives of regulatory or enforcement agencies having jurisdiction.

3.04 REMOVAL

Immediately upon completion of the dewatering system, the Contractor shall remove all of his equipment, materials, and supplies from the site of the Work, remove all surplus materials and debris, fill in all holes or excavations, and grade the site to elevations of the surface levels which existed before work started. The site shall be thoroughly cleaned and approved by the OWNER.

END OF SECTION

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SECTION 02215

FINISH GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Provide finish grading to all areas within the limits of construction.
- B. Grade sub-soil. Cut out areas to receive stabilizing base course materials for paving and sidewalks. Place, finish grade, and compact topsoil.

1.02 PROTECTION

- A. Prevent damage to existing fencing, trees, landscaping, natural features, benchmarks, pavement, and utility lines. Correct damage at no cost to the County.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Topsoil: Friable loam free from subsoil, roots, grass, excessive amount of weeds, stones, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4% and a maximum of 25% organic matter. The topsoil shall be suitable for the proposed plant growth shown on the Drawings and specified. Use topsoil stockpiles on site if conforming to these requirements. If there is not sufficient topsoil available at the project site, the Contractor shall furnish additional topsoil as required to complete the Work at no additional cost to the County.

PART 3 - EXECUTION

3.01 SUB SOIL PREPARATION

- A. Rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, etc. Remove sub-soil that has been contaminated with petroleum products.
- B. Cut out areas to subgrade elevation which are to receive stabilizing base for paving and sidewalks.

- C. Bring sub soil to required levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- D. Slope grade away from building a minimum of 2-inches in 10-feet unless indicated otherwise on the Drawings.
- E. Cultivate subgrade to a depth of 3-inches where topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted sub-soil.

3.02 PLACING TOPSOIL

- A. Place topsoil in areas where seeding, sodding, and planting is to be performed. Place to the following minimum depths, up to finished grade elevations.
 - 1. 6-inches for seeded areas
 - 2. 4-1/2-inches for sodded areas
 - 3. 24-inches for shrub beds
 - 4. 18-inches for flower beds
- B. Use topsoil in relatively dry state. Place during dry weather.
- C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of subgrades.
- D. Remove stones, roots, grass, weeds, debris, and other foreign material while spreading.
- E. Manually spread topsoil around trees, plants, and buildings to prevent damage which may be caused by grading equipment.
- F. Lightly compact placed topsoil.

3.03 SURPLUS MATERIAL

- A. Remove surplus sub soil and topsoil from site.
- B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 02220
EXCAVATING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Excavate, backfill, and compact as required for the construction of the utility system consisting of piping and appurtenances, and structural construction as shown on the Drawings and specified herein. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, compaction, grading, and slope protection to complete the Work. The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, all under ground utilities locations and appurtenances shown on the construction Drawings.
- B. Definitions:
1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material as determined by AASHTO T-180 (ASTM D155).
 2. Optimum Moisture: Percentage of water in a specific material at maximum density.
 3. Rock Excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
 4. Suitable: Suitable materials for fills shall be non-cohesive, non-plastic granular local sand and shall be free from vegetation, organic material, marl, silt, or muck. The Contractor shall furnish all additional fill material required.
 5. Unsuitable: Unsuitable materials are highly organic soil (peat or muck) classified as A-8 in accordance with AASHTO Designation M 145.
- C. Plan For Earthwork: The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the Work, the general and local conditions, and all other matters which can in any way affect the Work under this Contract. Prior to commencing the excavation, the Contractor shall submit a plan of his proposed operations, including maintenance of traffic, to the OWNER for review. The Contractor shall consider, and his plan for excavation shall reflect, the equipment and methods to be employed in the excavation. The prices established in the Proposal for the Work to be done will reflect all costs pertaining to the Work.

1.02 QUALITY ASSURANCE

- A. Testing laboratory employed by the Contractor will make such tests as are deemed advisable. The Contractor shall schedule his work to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Costs for initial testing shall be paid by the Contractor; however, tests which have to be repeated because of the failure of the tested material to meet specification shall also be paid for by the Contractor.
- B. At the direction of the Engineer, the Testing laboratory, employed by the Contractor, shall provide the engineer of record soil samples and testing results in the event unsuitable or questionable soils are encountered during excavation, backfilling and compacting operations. Tests and samples shall be taken as directed by the engineer of record at random and specific sample locations throughout the project site to confirm the soils mechanical properties necessary to evaluate the performance of the design requirements and intent for the project.
- C. Standards
 - 1. AASHTO: American Association of State Highway and Transportation Officials
 - 2. ANSI: American National Standards Institute
 - 3. ASCE: American Society of Civil Engineers
 - 4. ASTM: American Society for Testing and Materials
 - 5. AWWA: American Water Works Association
 - 6. OSHA 29 CFR Subpart P – Excavations and Trenches a) 1926.650, 1926.651, 1926.652
 - 7. OSHA 29 CFR Subpart J - a) 1910.146 for Confined Space Entry

1.03 JOB CONDITIONS

- A. Existing Utilities
 - 1. The Contractor is responsible for subsurface verification of existing utilities prior to construction. Locate existing utilities in the area of work in accordance with Sunshine State One Call regulations, Chapter 556, "Underground Facility Damage Prevention and Safety Act", FS.
 - 2. Should uncharted or incorrectly charted piping or other utility be encountered during excavation, notify the OWNER. Keep all facilities in operation and repair damaged utilities to the satisfaction of the OWNER.
 - 3. Damage and repair costs to such piping or utilities are the Contractor's responsibility.
 - 4. If utilities are to remain in place, the Contractor shall provide adequate means of protection.
- B. Test borings and the sub-surface exploration data if previously done on the site will be made available upon request and are for the Contractor's information only.

1.04 PROTECTION

- A. Sheet piling and Bracing

1. Requirements of the Trench Safety Act shall be adhered to at all times.
2. Furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, to protect adjacent structures and power poles from undermining, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other acceptable methods. If the OWNER is of the opinion that at any point sufficient or proper supports have not been provided, the OWNER may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete or approved clean granular stone shall be used as backfill at no additional expense to the OWNER.
3. The Contractor shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected by the Contractor at their own expense so as to provide the necessary clearances and dimensions.
4. Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a Professional Geotechnical Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design, and the Professional Engineer shall provide certification of this.
5. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.
6. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the OWNER may direct him in writing to leave in place at any time during the progress of the Work for the purpose of preventing damage to structures, utilities, or property, whether public or private. The OWNER may direct that timber used for sheeting and bracing be cut off at any specified elevation.
7. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed by the OWNER.
8. The right of the OWNER to order sheeting and bracing left in place shall not be construed as creating any obligation on the OWNER's part to issue such orders, and their failure to exercise this right shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the Work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the

ground.

9. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1-foot above the top of any pipe.

B. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing the water level to return to the natural level as stipulated in Section 02140 "Dewatering." The Contractor shall engage a Professional Geotechnical Engineer registered in the State of Florida to design the dewatering systems. The Contractor shall submit to the OWNER a plan for dewatering systems prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan, and the Professional Engineer shall provide certification of this. The Professional Engineer shall be required to monitor the performance of the dewatering systems during the progress of the Work and require such modifications as may be required to assure that the systems are performing satisfactorily.
2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed bottom of excavation and to preserve the integrity of adjacent structures. Dewatering by trench pumping will not be permitted if migration of fine grained natural material from bottom, sidewalls, or bedding material will occur.
3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
4. The Contractor shall take all additional precautions to prevent uplift of any structure during construction.
5. Permission to use any storm sewers or drains for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. However, the Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the OWNER or the authority having jurisdiction, at no cost to the OWNER.
6. The Contractor shall prevent flotation by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.
7. Removal of dewatering equipment shall be accomplished after compaction/density testing has been completed and the system is no longer required. The Contractor shall remove the material and equipment constituting the system.
8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, or other contaminants in order to prevent adverse effects on groundwater quality.

1.05 TESTING AND INSPECTION SERVICE

- A. The Contractor will provide a geotechnical testing and inspection service. The services include testing soil materials and quality control testing during filling and backfilling operations. Samples of soil materials shall be furnished to the testing service by the Contractor.
- B. The Contractor shall provide monthly density testing reports to the OWNER during backfilling activities. Density testing reports not submitted in a timely manner shall result in rejection of the pipe installed and rejection of the density testing reports until such time that density re-testing is coordinated and repeated at the Contractors expense.
- C. Density testing scheduled subsequent to backfilling activities shall be coordinated with, and witnessed by the OWNER. Failure by the Contractor to coordinate or have the OWNER present shall result in rejection of the submitted density testing reports and re-testing at the Contractor's expense.
- D. Dewatering systems shall not be removed until compaction/density testing has been completed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General:
 - 1. All fill material shall be subject to the review and acceptance of the OWNER.
 - 2. All fill material shall be free of organic material, trash, or other objectionable material. The Contractor shall remove excess or unsuitable material from the job site.
- B. Common Fill Material: Common fill shall consist of mineral soil, substantially free of clay, organic material, muck, loam, wood, trash, and other objectionable material which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than 3-1/2-inches in any dimension in the top 12-inches or 6-inches in any dimension in the balance of fill area. Common fill shall not contain asphalt, broken concrete, masonry, rubble or other similar materials. It shall have physical properties that allow it to be easily spread and compacted during filling. Additional common fill shall be no more than 12 % by weight finer than the No. 200 mesh sieve, unless finer material is approved for use in a specific location by the OWNER. Select Common Fill shall be as specified as above from common fill, except that the material shall contain no stones larger than 1/2-inches in largest dimension, and shall be no more than 5 % by weight finer than the No. 200 mesh sieve.
- C. Structural Fill: Structural fill shall be reasonably well graded sand to gravelly sand having the following gradation:

US Sieve Size	Percent Passing By Weight
No. 1	100

No. 4	75 - 100
No. 40	15 - 80
No. 100	0 - 30
No. 200	0 - 12

- D. Class 1 Soils*: Manufactured angular, granular material, 1/4 to 1-1/2-inches (6 to 4 mm) size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming to ASTM C33 stone size No. 89 and with particle size limits as follows:

U.S. Sieve Size	% Passing By Weight
1/2	100
3/8	100
No. 4	20 – 25
No. 8	5 – 30
No. 16	0 - 10
No. 50	0 - 2

- E. Class II Soils**:

1. GW: Well graded gravels and gravel-sand mixtures, little or no fines. Fifty percent or more retained on No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.
2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty percent or more retained on No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.
3. SW: Well graded sands and gravelly sands, little or no fines. More than passes No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.
4. SP: Poorly graded sands and gravelly sands, little or no fines. More than 50 % passes No. 4 sieve. More than 95 % retained on No. 200 sieve. Clean.

*Soils defined as Class I materials are not defined in ASTM D2487.

**In accordance with ASTM D2487, less than 5 % pass No. 200 sieve.

- F. Coarse Sand: Sand shall consist of clean mineral aggregate with particle size limits as follows:

U.S. Sieve Size	Percent Passing By Weight
3/8	100
No. 10	85 – 100
No. 40	20 – 40
No. 200	0 - 12

- G. Other Material: All other material, not specifically described, but required for proper completion of the Work shall be selected by the Contractor and acceptable by the OWNER.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clearing:

1. The construction areas shall be cleared of all obstructions and vegetation including large roots and undergrowth within 10-feet of the lines of the excavation.
2. Strip and stockpile topsoil on the site at the location to be determined by the OWNER.

3.02 EXCAVATION

A. General: Excavations for roadways, structures, and utilities must be carefully executed in order to avoid interruption of utility service.

B. Excavating for Roadways/Structures/Utilities:

1. Excavation shall be made to such dimensions as will give suitable room for building the foundations and the structures, for bracing and supporting, for pumping and draining, and for all other work required.
 - a. Excavation for precast or prefabricated structures shall be carried to an elevation 2-feet lower than the proposed outside bottom of the structure to provide space for the select backfill material. Prior to placing the select backfill, the excavation shall be measured by the OWNER to verify that the excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.
 - b. Excavation for structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with Class B concrete.
 - c. Footings: Cast-in-place concrete footing sides shall be formed immediately after excavation.
2. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.
3. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the Work.
4. Encounters with subsurface obstructions shall be hand excavated.
5. Excavation and dewatering shall be accomplished by methods that preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods shall be removed and replaced by crushed stone as required by the OWNER at the Contractor's expense.
6. The bottom of excavations shall be rendered firm and dry before placing any piping or structure.

7. All pavements shall be cut with saws or approved power tools prior to removal.
8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor.

3.03 DRAINAGE

- A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.
- B. All water pumped or drained from the Work shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.
- C. No construction, including pipe laying, shall be allowed in water. No water shall be allowed to contact masonry or concrete within 24-hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.
- D. The Contractor will be required at his expense to excavate below grade and refill with crushed stone (gradation 57 or 89) or other acceptable fill material if the OWNER determines that adequate dewatering has not been provided.

3.04 UNDERCUT

- A. If the bottom of any excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavation methods, he shall refill to normal grade with fill at his own cost. Fill material and compaction method shall be approved by the OWNER.

3.05 FILL AND COMPACTION

- A. Compact and backfill excavations and construct embankment according to the following schedule. (Modified Proctor standard shall be ASTM D-1557):

STRUCTURES AND ROADWORK

Area	Material	Compaction
Beneath Structures	Structural Fill	12-inch lifts, compacted to 98% maximum density as determined by AASHTO T-180. Fill Should not be placed over any in-place soils until those deposits have been compacted to 98% Modified Proctor.
Around Structures	Structural Fill	12-inch lifts, 95% of maximum density as determined by AASHTO T-180.

Beneath Paved Surfaces	Common Fill	Rubber Tire or vibratory plate compactors shall be used 12-inch lifts, 98% by maximum density as determined by AASHTO T-180 or as required by the FDOT Standards.
Open Areas	Common Fill	12-inch lifts, 95% by maximum density as determined by AASHTO T-180.

- B. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.
- C. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. The backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.
- D. Embankments shall be constructed true to lines, grades, and cross sections shown on the plans or ordered by the OWNER. Embankments shall be placed in successive layers of not more than 8-inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the Work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.
- E. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the OWNER. Acceptance will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The OWNER's acceptance shall be in writing.
- F. One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around structures as a minimum. The OWNER may determine that more compaction tests are required to certify the installation depending on field conditions. The locations of the compaction tests within the trench shall be in conformance with the following schedule:
 - 1. At least one test at the spring line of the pipe.
 - 2. At least one test for each 12-inch layer of backfill within the pipe bedding zone for pipes 24-inches and larger.
 - 3. One test at an elevation of 1-foot above the top of pipe.
 - 4. One test for each 2-feet of backfill placed from 1-foot above the top of the pipe to finished grade elevation.
 - 5. Density testing is required for sanitary sewer manholes and structures. Tests shall be staggered around the structure within 3-feet of the structures outside perimeter.
 - a. First test shall be 1-foot above the structure base.
 - b. Second test shall be 2-feet above the first test and subsequent tests every 2-feet up the finished grade.
 - 6. The Contractor shall provide additional compaction and testing prior to commencing further construction if the Contractor's testing reports and inspection indicate that the fill has been placed below specified density.
 - 7. The Contractor shall coordinate testing with the approved testing laboratory and shall provide monthly test results to the OWNER in a timely manner during construction

activities. Density testing scheduled subsequent to backfilling activities shall be coordinated and witnessed by the OWNER representative. Failure by the Contractor to coordinate or have the OWNER representative present shall result in rejection of the submitted density testing reports and re-testing at the Contractor's expense. Density testing reports not submitted in a timely manner shall result in rejection of the pipe installed and rejection of the density testing reports until such time that density re-testing is coordinated and repeated at the Contractor's expense as deemed necessary by the OWNER's representative.

8. Dewatering systems shall not be removed until compaction/density testing has been completed.

END OF SECTION

SECTION 02576
CONCRETE SIDEWALKS AND DRIVEWAYS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Constructing new concrete sidewalks, driveways, and curb and gutters as shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. Codes and Standards: Comply with applicable sections of F.D.O.T. Specifications and local governing regulations.
- B. The mixture, placement, and curing of all concrete work shall be in accordance with F.D.O.T. Specifications.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the OWNER for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Furnish manufacturer's product data, design mixes, test reports, and materials certifications.

1.04 JOB CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities, as specified under Section 01570 "Maintenance of Traffic."
- B. Utilize flagman, barricades, warning signs, and warning lights as required.

1.05 GUARANTEE

- A. All restored areas within the public right-of-way shall be guaranteed for 1-year after final acceptance. In the event of cracked or broken concrete surfaces, the Contractor shall make the necessary repairs to restore the concrete within 10-calendar days after notification by the OWNER. The cost of such repairs shall be paid by the Contractor.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

- A. Forms: Steel or wood for each type of use of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
 - 1. Use flexible spring steel forms or laminated boards to form radius bends as required.
 - 2. Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete.
- B. Fibermesh Reinforcement: Fibermesh reinforcement fibers shall be 2-inches to 3-inches collated polypropylene fibers. Fibers shall be in strict accordance with the manufacturer recommendations and within the time as specified in ASTM C94, Type III 4.13 and applicable building codes.
- C. Concrete Materials: Comply with requirements of F.D.O.T. Section 347 for concrete materials, admixtures, bonding materials, curing materials, and others as required.
- D. Epoxy Resin Grout: Type N as specified in F.D.O.T. Section 926.
- E. Aggregate, brick, or other material required to match existing driveway or walk shall be as approved by the OWNER.

2.02 CONCRETE MIX, DESIGN, AND TESTING

- A. Comply with requirements of applicable F.D.O.T. Section 347 for concrete mix design, sampling and testing, and quality control, and as herein specified.
- B. Design the mix to produce standard weight concrete consisting of Portland cement, aggregate, air entraining admixture, and water to produce the following properties.
 - 1. Compressive Strength: 3,000 psi for driveways, sidewalks and curbs.
 - 2. Air Content: 3% to 6% .
- C. Concrete slump shall not exceed plus or minus 1-inch from approved design slump.

PART 3 - EXECUTION

3.01 CONCRETE SIDEWALK, DRIVEWAY, AND CURB AND GUTTER

- A. Surface Preparation:
 - 1. Remove loose material from the compacted sub base surface immediately before placing concrete.
 - 2. Proof-roll prepared sub base surface to check for unstable areas and the need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Form Construction:

1. Set forms to the required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of the Work and so that forms can remain in place at least 24-hours after concrete placement.
2. Check completed form work for grade alignment to the following tolerances:
 - a. Top of forms not more than 1/8-inch in 10-feet.
 - b. Vertical face on longitudinal axis, not more than 1/4-inch in 10-feet.
3. Clean forms for reuse immediately after use, and coat with form release agent as often as required to ensure separation from concrete without damage.

C. Concrete Placement:

1. Do not place concrete until sub base and forms have been checked for line and grade. Moisten if required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are completed to required finish elevation and alignment. Use special colors or aggregate as required to match existing material.
2. Place concrete using methods which prevent segregation of the mix. Consolidate concrete along the face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices. Do not use vibrators to push or move concrete in forms or chute.
3. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.
4. An automatic machine may be used for sidewalk or curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed the minimum herein specified. Machine placement must produce sidewalks and/or curbs and gutters to the required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.
5. Joints: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of the concrete, unless otherwise indicated. Construct transverse joints at right angles to the centerline, unless otherwise indicated. When joining existing structures place transverse joints to align with previously placed joints, unless otherwise indicated.
 - a. Weakened-Plane Joints: Provide weakened-plane (contraction) joints sectioning concrete into areas as shown on the Drawings. Construct weakened plane joints for a depth equal to at least 1/4 concrete thickness, by sawing within 24-hours of placement or formed during finishing operations. Place joints at intervals not to exceed 10-feet if not otherwise indicated.
 - b. Construction Joints: Place construction joints at the end of all pours and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such pours terminate at expansion joints. Construction joints shall be as shown or, if not shown, use standard metal keyway-section form of appropriate height.
 - c. Expansion Joints:

- (1) Provide premolded joint filler for expansion joints abutting concrete curbs, catch basin, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.
- (2) Locate expansion joints at 12-feet on center for concrete walks unless otherwise indicated.
- (3) Extend joint fillers full-width and depth of joint, and not less than 1/2-inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
- (4) Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Pieces shorter than 4-inches shall not be used unless specifically shown as such.
- (5) Protect the top edge of the joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.
- (6) Fillers and Sealants: Comply with the requirements of these specifications for preparation of joints, materials installation, and performance, and as herein specified.

D. Concrete Finishing:

1. After striking-off and consolidating concrete, smooth the surface by screening and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.
2. After floating, test surface for trueness with a 20-foot straightedge. Variations exceeding 1/3-inch for any two points within 10-feet shall not be acceptable. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
3. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round 10-1/2-inch radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.
4. After completion of floating and when excess moisture or surface sheen has disappeared, broom finish sidewalks by drawing a fine-hair broom across concrete surface, perpendicular to a line of pedestrian traffic. If the existing material has another finish, match existing finish.
5. Do not remove forms for 24-hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas.

E. Curing:

Protect and cure finished concrete paving and walks, complying with applicable requirements of F.D.O.T. Section 350. Use moist-curing methods for initial curing of approved concrete curing compounds whenever possible.

F. Repairs and Protections:

1. Repair or replace broken or defective concrete, as directed by the OWNER.
2. Drill test cores where directed by the OWNER, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy resin

- grout.
3. Protect concrete from damage until acceptance of work. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
 4. Sweep concrete pavement and wash free of stains and discolorations, dirt, and other foreign material just prior to final inspection.

3.02 FIELD QUALITY CONTROL

- A. General: Repair or remove and replace unacceptable concrete sidewalk, driveways, or curb and gutter as directed by the OWNER.
- B. Surface Elevation: Actual surface elevations shall be within ± 0.05 feet of specified or indicated elevations at any given point. Surface elevations between any 2 given points shall be interpolated from a direct line between the 2 points. Surfaces exceeding actual elevation tolerances of more than ± 0.05 feet at any 2 points within a distance of 15-feet will not be acceptable.

END OF SECTION

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SECTION 02578

SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Establishing a stand of grass by furnishing and placing grass sod. Included are fertilizing, watering, and maintenance as required to assure a healthy stand of grass. Solid sodding shall be placed on all slopes greater than 4:1, within 10-feet of all proposed structures, and in all areas where existing grass or sod (regardless of it's condition) is removed or disturbed by Contractor's operation unless otherwise specified or shown on the Drawings.

1.02 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the OWNER for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
 - 1. A certification of sod quality by the producer shall be delivered to the OWNER ten days prior to use.

PART 2 - PRODUCTS

2.01 GENERAL

2.02 GRASS SOD

- A. Grass sod for the road rights-of-way shall be of variety to match the existing adjacent area and shall be well matted with grass roots. The sod shall be taken up in rectangles, preferably 12-inch by 24-inch, shall be a minimum of 2-inches in thickness, and shall be live, fresh, and uninjured at the time of planting.
- B. Grass sod for restoration of new construction sites and/or areas disturbed by construction on existing sites shall be St. Augustine well matted with grass roots. The sod shall be taken up in rectangles, preferably 12-inch by 24-inch, shall be a minimum of 2-inches in thickness, and shall be live, fresh, and uninjured at the time of planting.

- C. It shall be reasonably free of weeds and other grasses and shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. The sod shall be planted as soon as possible after being dug and shall be shaded and kept moist until it is planted.

2.03 FERTILIZER

- A. Commercial fertilizers shall comply with the state fertilizer laws.
- B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid, and (3) water-soluble potash contained in the fertilizer.
- C. The chemical designation of the fertilizer shall be 6-6-6. At least 50% of the nitrogen shall be derived from organic sources. At least 50 % of the phosphoric acid shall be from normal super phosphate or an equivalent source, which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container.

2.04 WATER FOR GRASSING

- A. The water used in the sodding operations shall be by the Contractor as approved by the OWNER.

PART 3 - EXECUTION

3.01 PREPARATION OF GROUND

- A. The area over which the sod is to be placed shall be scarified or loosened to a depth and then raked smooth and free from debris. Where the soil is sufficiently loose and clean, the OWNER, at its discretion, may authorize the elimination of ground preparation.

3.02 APPLICATION OF FERTILIZER

- A. Before applying fertilizer, the soil pH shall be brought to a range of 6.0 - 7.0.
- B. The fertilizer shall be spread uniformly over the area to be sodded at the rate of 700-pounds per acre, or 16-pounds per 1,000 square feet, by a spreading device capable of uniformly distributing the material at the specified rate. Immediately after spreading, the fertilizer shall be mixed with the soil to a depth of approximately 4-inches.
- C. On steep slopes, where the use of a machine for spreading or mixing is not practicable, the fertilizer shall be spread by hand and raked in and thoroughly mixed with the soil to a depth of approximately 2-inches.

3.03 PLACING SOD

- A. The sod shall be placed on the prepared surface, with edges in close contact and shall be firmly and smoothly embedded by light tamping with appropriate tools.
- B. Where sodding is used in drainage ditches, or on slopes of 4:1 or greater, the setting of the pieces shall be staggered to avoid a continuous seam along the line of flow. Along the edges of such staggered areas, the offsets of individual strips shall not exceed 6-inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped so as to produce a featheredge effect.
- C. On slopes greater than 2:1, the Contractor shall, if necessary, prevent the sod from sliding by means of wooden pegs driven through the sod blocks into firm earth at suitable intervals.
- D. Sod which has been cut for more than 72-hours shall not be used unless specifically authorized by the OWNER after the inspection thereof. Sod which is not planted within 24-hours after cutting shall be stacked in an approved manner, maintained, and properly moistened. Any pieces of sod that, after placing, show an appearance of extreme dryness shall be removed and replaced by fresh, uninjured pieces.
- E. Sodding shall not be performed when weather and soil conditions are, in the OWNER's opinion, unsuitable for proper results.

3.04 WATERING

- A. The areas on which the sod is to be placed shall contain sufficient moisture, as determined by the OWNER, for optimum results. After being placed, the sod shall be kept in a moist condition to the full depth of the rooting zone for at least 2-weeks. Thereafter, the Contractor shall apply water as needed until the sod roots and starts to grow for a minimum of 60-days (or until final acceptance, whichever is latest).

3.05 MAINTENANCE

- A. The Contractor shall maintain, at his expense, the sodded areas in a satisfactory condition until final acceptance of the Project. Such maintenance shall include repairing of any damaged areas and replacing areas in which the establishment of the grass stand does not appear to be developing satisfactorily.
- B. Replanting or repair necessary due to the Contractor's negligence, carelessness, or failure to provide routine maintenance shall be at the Contractor's expense.

END OF SECTION

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SECTION 02730 - UNDERGROUND VACUUM SEWER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The plans and general provisions of the Contract, including General and Supplementary Conditions and Division-2, Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. The extent of the vacuum sewer work is shown on the drawings. The work includes installation of vacuum mains, valves pits and division valves.
- B. Testing of vacuum sewerage system is also included in this section. Comply with the requirements of applicable Division-2 sections for excavation and backfilling required in connection with vacuum sewer work.

1.3 WORK BY OWNER AND INSTALLATION CONTRACTOR:

- A. The OWNER shall purchase all vacuum valves, valve pits and associated equipment directly from the vacuum system manufacturer with the exception of the gravity line stub-outs. Unless stipulated otherwise, the CONTRACTOR shall be responsible for storage of all items.
- B. The INSTALLATION CONTRACTOR shall record all pertinent data relating to the valve pit installation on the vacuum system manufacturer's Valve Pit Installation Form and submit the completed forms to the OWNER at the completion of the project.
- C. The OWNER shall install vacuum valves in the valve pits when customer connects to the system.

1.4 WORK SPECIFIED ELSEWHERE:

- A. Trenching, Backfilling and Compaction (See Section 02220) Roadways, Drives, Sidewalks, Curb and Gutter Patching See Section 02220).

1.5 QUALITY ASSURANCE:

- A. Manufacturer's Experience: The vacuum system manufacturer shall have a minimum of five (5) years of experience in the manufacture of vacuum systems and shall have at least ten (10) installations in service within the United States of America. A "system" is defined as a vacuum sewer system collecting domestic wastewater that has been in operation for at least five (5) years which has at least 150 vacuum interface valves, and valve pits. Provide verification at the request of the ENGINEER.
- B. Acceptable vacuum system manufacturers: Airvac (Basis of design and manufacturer to be used in base bid) "or approved equal".

1.6 SUBMITTALS:

- A. Shop Drawings: Submit shop drawings and product data under provisions specified elsewhere. Indicate materials of construction, physical properties, controls, operational requirements, and details.
- B. Flushing procedures: Submit manufacturer's recommended line flushing procedure for ENGINEER's approval.
- C. Manufacturer's installation instructions: Submit manufacturer's installation instructions under provisions specified elsewhere.
- D. Manufacturer's Valve Pit Installation Forms: Submit manufacturer's Valve Pit Installation Form for ENGINEER's approval.
- E. Manufacturer's Final Inspection Form: Submit manufacturer's Final Inspection Form for ENGINEER's approval.
- F. Manufacturer's Vacuum Valve Installation Forms: Submit manufacturer's Vacuum Valve Installation Form for ENGINEER's approval.

1.7 CERTIFICATES AND FORMS:

- A. Pipe and pipe gasket: Provide a certificate from the pipe manufacturer stating the pipe gasket has been tested at 22 in. hg. vacuum with no leakage in accordance with ASTM D3139, and is guaranteed for such use.
- B. Fitting and fitting gasket: Provide a certificate from the fitting manufacturer that the fittings and fitting gasket has been tested at 22 in. hg. vacuum with no leakage in accordance with ASTM D3139, and is guaranteed for such use.
- C. Division valve: Submit division valve manufacturer's certificate that valve will not leak when subject to a vacuum of 22 inches mercury for one (1) hour in both open and closed position.

- D. Plan & profile: Provide a letter from the vacuum manufacturer indicating their acceptance of the plan and profiles as designed.
 - E. Valve Pit Installation Forms: Provide the OWNER with a complete set of Valve Pit Installation Forms. One form is required for each valve pit installed. Each form must be signed by the CONTRACTOR certifying that all required pressure tests have been successfully completed and that all sump cut-outs (coupons) have been removed from the sump.
 - F. Final Inspection Form: Provide the OWNER with a signed copy of the Final Inspection Form.
 - G. Vacuum Valve Installation Forms: Provide the OWNER with a complete set of Vacuum Valve Installation Forms certifying the proper installation and testing of each vacuum valve placed into service.
- 1.8 OPERATION AND MAINTENANCE MANUALS:
- A. None Required.
- 1.9 WARRANTY:
- A. CONTRACTOR to provide two (2) year manufacturer's product warrant (Exception; One (1) year warranty for Trailer Mounted Vacuum Pump). Manufacturer's warranty shall commence on date of substantial completion or 30 months from date of delivery, whichever comes first.
 - B. CONTRACTOR to provide a one (1) year installation warranty. Warranty shall commence on date of substantial completion.
- 1.10 DELIVERY, STORAGE and HANDLING:
- A. Cast iron rings and covers, complete valve pits and all components that make up the hybrid two-piece pits may be stored outside. If any such material is to be stored in excess of 2 years (such as spares for future work), temporary shading is required. Simple covering of these products which allows temperature buildup or exposure to direct or indirect sunlight is not permitted.
 - B. Suction and sensor pipes and flexible service laterals shall be stored in a manner that will keep them at ambient outdoor temperatures and out of the sunlight. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings, which allows temperature buildup or exposure to direct or indirect sunlight, is not permitted.

- C. Boxes of grommets shall be kept in a dry area.
- D. 3" Vacuum valves with controllers, sump breathers, and installation parts bags shall be kept in a dry area. For safe storage, the individual cartons are to remain intact while in storage. Temperature surrounding the boxes while in storage shall not exceed 110 degrees.
- E. Valve pit cones: Fiberglass valve pit cones may be stacked or laid on their sides. Stack shall be limited to a maximum of eight (8) valve pit cones. PE valve pit cones may not be laid on their side but must be stacked upright on a pallet with a maximum stack of three (3).
- F. Collection sumps: Collection sumps shall be stacked upside-down on pallets.
- G. Cast iron rings and covers shall be stacked on pallets. Rings and covers shall be on separate pallets

DIVISION 2 - SITE WORK

SECTION 02730 - UNDERGROUND VACUUM SEWER PIPING

PART 2 - PRODUCTS

2.1 VACUUM SEWER PIPE:

- A. Pipe: All buried vacuum mainlines, branch lines and service laterals shall be gasketed PVC SDR 21, 200 psi pressure rated pipe per ASTM D-2241 and ASTM D3139.
- B. Pipe gasket: Elastomeric joints are to be "Rieber Style" or approved equal. Manufacturer is required to submit a certification that the pipe seal will operate at 22 inches of mercury vacuum and withstand a vacuum test at 22 inches of mercury vacuum with no leakage after 1 hour with joints deflected as per ASTM D3139.
- C. Fittings – Bends
 - 1. 45 Ells shall be used throughout. Tee fittings, 90-degree ells and vent type ells are not permitted with the exception that a 90-degree ell may be used inside the valve pit to join the 3" suction pipe to the 3" vacuum valve.
 - 2. Molded Solvent Weld Fittings: Shall be PVC Schedule 40 per ASTM D2466 from a PVC compound having a cell classification of 12454 conforming to ASTM D-1784. Manufacturer shall submit a certification that the fittings will operate at and withstand a vacuum test at 22 inches of mercury vacuum for 1 hour with no leakage with joints deflected as per ASTM D3139. Such fittings shall be as produced by Spears Manufacturing Company (or approved equal).
 - 3. Assembled Gasket Joint Fittings: Shall be assembled from molded Schedule 40 fittings per ASTM D-2466 and Spigot x Gasket Adapters fabricated from SDR21, 200 psi pressure rated pipe per ASTM D2241. Gasketed joints shall be "Rieber Style" (or approved equal) 200 psi rated complying with ASTM D3139. Gasket material shall be EPDM or SBR unless otherwise specified. Fittings shall be marked "vacuum rated" with a weatherproof label affixed to each fitting clearly observable for inspection. Manufacturer shall submit a certification that the fittings will operate at and withstand a vacuum test at 22 inches of mercury vacuum for 1 hour with no leakage with joints deflected as per ASTM D3139. Such fittings shall be as manufactured by Specified Fittings of Bellingham, Washington, Harco Fittings of Lynchburg, Virginia, or approved equal.
 - 4. Fabricated, miter cut, butt fused joints are not permitted.

D. Fittings – Wyes

1. Fabricated solvent weld: Wye fittings may be fabricated per the requirements of 2.1.C.2. Fabricated Wye's shall be marked "vacuum rated" with a weatherproof label clearly observable for inspection. Manufacturer shall submit a certification that the fittings will operate at and withstand a vacuum test at 22 inches of mercury vacuum for 1 hour with no leakage with joints deflected as per ASTM D3139. Such fittings shall be as manufactured by Spears Manufacturing Company (or approved equal).
 2. Fabricated or Assembled Gasket Joint Fittings: Shall be IPS diameter fabricated from SDR 21, 200 psi pressure rated PVC pipe per ASTM D2241 or assembled from Schedule 40 fittings per ASTM D-2466, with either fitting form using Spigot x Gasket Adapters fabricated from SDR21, 200 psi pressure rated pipe per ASTM D2241. Gasketed joints shall be "Rieber Style" (or approved equal) 200 psi rated complying with ASTM D3139. Gasket material shall be EPDM or SBR unless otherwise specified. Fittings shall be marked "vacuum rated" with a weatherproof label affixed to each fitting clearly observable for inspection. Manufacturer shall submit a certification that the fittings will operate at and withstand a vacuum test at 22 inches of mercury vacuum for 1 hour with no leakage with joints deflected as per ASTM D3139. Such fittings shall be as manufactured by Specified Fittings of Bellingham, Washington, Harco Fittings of Lynchburg, Virginia, or approved equal.
 3. Fabricated, miter cut, butt fused joints are not permitted.
- E. Primer: Primer shall be per ASTM F-656.
- F. Solvent Cement: Solvent cement shall be per ASTM 2564. Solvent cement shall not be same color as the primer.

2.2 GRAVITY SEWER PIPE (Stub-out pipes and House laterals):

- A. All valve pit stub-out pipes, gravity laterals and fittings installed in the public right-of-way shall be pressure rated. Non-pressure rate pipe and fittings and foam core pipe is not acceptable.
- B. Pipe: SDR21 & SDR 26: ASTM D2241; Sch 40: ASTM D1784.
- C. Fittings: Sch 40: ASTM D1784 and ASTM D 2466
- D. Stub outs: Stub-outs shall be of the pipe material specified in 2.2.B and shall be 4" or 6" in diameter and a minimum of 6 feet long or the length necessary to extend service to the property line.
- E. House laterals: Any gravity house lateral pipe that is connected to the valve pit stub-out shall be of the pipe material specified in 2.2.B.

2.3 VACUUM LINE DIVISION VALVES:

- A. Valves shall conform to AWWA C509087, Standard for Resilient Seated Gate Valves, as manufactured by Waterous Company or approved equal.
- B. Wedge shall be constructed of ductile iron, fully encapsulated in synthetic rubber except for guide and wedge nut areas.
- C. Wedge rubber shall be molded in place and bonded to the ductile iron portion, and shall not be mechanically attached with screws, rivets, or similar fasteners.
- D. Wedge shall seat against seating surfaces arranged symmetrically about the centerline of the operating stem, so that seating is equally effective regardless of direction of pressure unbalance across the wedge.
- E. All seating surfaces in body shall be inclined to the vertical at a minimum angle of 32° (when stem is in a vertical position) to eliminate abrasive wear of rubber sealing surfaces.
- F. Stem shall be sealed by at least two (2) O-Rings; all stem seals shall be replaceable with valve wide open and while subjected to full rated pressure.
- G. Waterway shall be smooth and shall have no depressions or cavities in seat area where foreign material can lodge and prevent closure or sealing.
- H. Valve body and bonnet shall be coated, inside and out, with fusion-bonded epoxy. Coating shall conform to AWWA C550-81, Standard for Protective Interior Coating for Valves and Hydrants.
- I. Mechanical joint connections with transition to PVC gaskets shall be provided.
- J. Two (2) tee keys shall be provided for each valve size required.
- K. Buried valves shall be provided with valve boxes and the operating nut shall be extended to within 9", plus or minus 6", of the finished grade. The valve box cover shall have the words "SEWER" and "OPEN" with a directional arrow cast on it.
- L. Manufacturer shall provide a full ten (10) year money back warranty.

2.4 VALVE PITS -GENERAL

- A. Valve pit types: Valve pits shall be provided in the following types and depths as shown in the ENGINEER's plans.

Two (2) Piece Hybrid Valve Pits (material: fiberglass & polyethylene)				
Airvac Model No.	Nominal Depth	Actual Depth	Depth to invert of gravity inlet stub-out	Sump capacity
VP3042H	6 ft	6.04 ft	4.71 ft	85 gal

- B. Separating barrier: All valve pits shall incorporate a physical barrier, part of the collection sump, that separates the valve chamber from the collection sump.
- C. Traffic rated: All valve pits shall be H20 traffic rated on their own merits without a concrete collar included in the rating process. An independent laboratory certification shall be provided that the entire valve pit assembly is rated for H20 traffic wheel loads. Calculated data is not acceptable.
- D. In-sump breather: All valve pits shall include an internal "in-sump" breather. No external breather piping or tubing will be acceptable. The sump breather is to be as described in paragraph 2.11.
- E. Grommet and twist lock hole seal lubricant: Type of lubricant used shall be as follows:

Type of Lubricant	Permitted	Where used
Pipe lubricant per ANSI/NSF Standard #61	Either water soluble or non-water soluble is permitted	Grommets for gravity stub-outs and vacuum service laterals (all valve pits)
Liquid dishwashing detergent diluted 10-20% in water	Pipe lubricant not permitted	Grommets for suction & sensor pipes and in-sump breather (2-piece pits only)

- F. Manufacturer: Valve pits and accessories as manufactured by Airvac.

2.5 VALVE PITS (2-PIECE TYPE – fiberglass & polyethylene)

Described below is the Model VP3042H valve pit. The other 2-piece model H valve pits differ only by dimensions relating to depth.

- A. Type: Valve pit shall have two (2) major components: 1) the valve pit cone; and (2) the collection sump as well as associated pipes, connectors, seals and grommets. Overall depth shall be 72" nominal.
- B. Valve pit cone: The valve pit cone shall be manufactured by filament winding fiberglass process with a 36" inside diameter at bottom and conically shaped to allow fitting a 26 ¾" frame with a 23 ½" inch diameter clear opening cast iron cover. The valve pit cone shall have a depth of 42" and a wall thickness of 3/16".
- C. Collection sump: The collection sump and integral pit bottom shall be manufactured by the rotational molding process using polyethylene (PE). It shall be tapered with the upper rim designed to accept the valve pit cone as described in paragraph B above. The collection sump shall have an overall height of 30" nominal with a capacity of 85 gallons. The collection sump shall have (4) stabilizing embosses to accept up to (4) gravity service connections with 4" or 6" PVC pipe (see Part 2 Products). Holes shall be field cut by the INSTALLATION CONTRACTOR.
- D. Suction and Sensor Pipes: Suction and sensor pipes shall be Sch 40 PVC. Lubricant shall be as specified in Part 2.4.E.
- E. Anti-buoyancy collar: Anti-buoyancy collars shall be manufactured from reinforced fiberglass and designed to prevent floatation of the valve pit when ground water is present at grade. Anti-buoyancy collar shall be a minimum of 53" square with rounded corners and a minimum ½" thick.
- F. Grommets: Holes for the house gravity line connections into the collection sump shall be field located and cut. EPDM Rubber grommets as manufactured by Airvac shall be used to make a watertight seal.
- G. Manufacturer: Valve pit model VP3042H as manufactured by Airvac.

2.6 FLEXIBLE CONNECTOR

- A. Flexible connector: Flexible connector shall be 3" in diameter with an overall length of 7'10 ¼" (+/-3/4") and shall incorporate a 4' 2" long piece of flexible pipe that is specially manufactured for Airvac. The flexible pipe shall have the proper outside diameter for solvent welding into PVC fittings. One end of the flexible pipe shall be joined to a piece of 3" Sch. 40 PVC pipe with a 3" Sch. 40 PVC coupling. The opposite end of the flexible pipe shall be fitted with a 3" Sch. 40 PVC coupling.
- B. Manufacturer: Flexible connectors as manufactured by Airvac.

2.7 VALVE PIT COVERS

- A. Valve pit covers: Valve pit covers shall be designed for H-20 loading. Castings shall meet ASTM A-48, Class 35B gray cast iron.
- B. Identification markings: The words "Airvac SEWER" shall appear on top of cover in 1" tall lettering.
- C. Pick holes: Covers for the two-piece valve pits shall have an open pick hole and no elastomer seal.
- D. Concrete collars (2-piece pits): Concrete collars are required for all Airvac 2-piece valve pits located in traffic areas. See Engineer's drawings and/or specifications for definition of 'traffic areas' as well as the design details of the collar.
- E. Manufacturer: 1116 Ring and BL Cover by US Foundry, Model R5900 by Neenah Foundry or equal.

2.8 VACUUM VALVE AND VALVE PIT INTERDEPENDENCE:

- A. Interdependence: The vacuum valve and valve pit shall be designed to function together as a complete system. Valve, valve pits and accessories shall be by the same manufacturer.
- B. Manufacturer: Vacuum valves, valve pits and accessories as manufactured by Airvac.

2.9 VACUUM VALVE:

- A. Design conformance: Vacuum valves shall be designed to minimize head loss through the valve and shall have a "Cv" factor of 256 or higher. An Independent laboratory certificate shall be supplied upon request.
- B. Type: Internal breather; Type F as manufactured by Airvac.
- C. Valve Construction: Full-port 3-inch diameter valve capable of passing a 3" diameter solid while matching the outside diameter of 3" SDR 21 PVC pipe. Valve to be vacuum operated on opening and spring assisted on closing; valve configuration arranged so that the system vacuum ensures positive valve seating. Valve plunger and shaft arranged to be completely out of the flow path when valve is in open position. Valve plunger and seat shall have no exposed metal parts that could allow ice buildup.
- D. Vacuum Operator: Self lubricating, rolling diaphragm type; diameter sufficient to open valve fully using line vacuum to overcome sealing force; equipped with elastomer seal where shaft enters housing; vacuum drain connected to housing to return seal leakage to sewer when valve cycles.

- E. Valve Position Switch: The valve position switch shall be IP67 rated and shall be internally installed in the lower housing. The valve position switch shall not require any alignment in order to activate. Valve position switches that require the use of magnetic sensor are prohibited.
- F. Lower housing electrical connections: An IP68 rated thermoplastic electrical connection shall be installed into the side of the lower housing. Connection contacts shall be gold plated and supplied with a rubber cover plug. Connectors shall have molded-in elastomer seal faces. Loose o-rings are prohibited. All electrical connections shall be epoxy encapsulated or plastic over-molded.
- G. Operation: Valve and sensor / controller require no outside power service.
- H. The valve shall be manufactured such that small objects may be removed from the valve seat area by means other than complete valve removal and disassembly.
- I. The valve and sensor/controller shall be capable of operation when submerged in water to a depth of 2 feet above the upper most component.
- J. Materials: Valves shall be chemically resistant to sewage and sewage gases. The valves shall be constructed from materials described in the following table.

COMPONENT	MATERIAL
Valve Body	Glass Filled Polypropylene
Valve Shaft	316 Stainless Steel
Valve Shaft Seal	Buna N Rubber
Valve O-Rings	Buna N Rubber
Valve Spring	304 Stainless Steel
Valve Plunger	Buna N Rubber
Valve Seat	Buna N Rubber
Valve Piston Cup	Polypropylene
Valve Bearing	Acetal
All Fasteners	316 Stainless Steel

- K. Furnished: Vacuum valves shall be furnished by the CONTRACTOR.
- L. Installed: Vacuum valves shall be installed by the OWNER.
- M. Manufacturer: Vacuum valve and accessories as manufactured by Airvac.

2.10 VACUUM VALVE SENSOR / CONTROLLER:

- A. The valve as described in paragraph 2.9 shall be equipped with a sensor-controller which shall rely on atmospheric air and vacuum pressure from the downstream side of the valve for its operation, thereby requiring no other power source. Rising liquid within the holding sump shall initiate the opening of the valve when sufficient head pressure is reached in the holding sump. The activation point shall equate to approximately 10 gallons of liquid. The controller shall apply line vacuum from the downstream side of the vacuum valve and apply it to the actuator chamber and fully open the valve.
- B. The Controller shall be capable of maintaining the valve fully open for a fixed period of time. This shall be field adjustable over a range of 3 to 10 seconds. After this time period has elapsed, the controller shall apply atmospheric air to the actuator chamber permitting spring assisted closure of the valve.
- C. The Controller shall have no internal tubing, nor use tubing for connection of timing components.
- D. The Controller shall not use a needle valve for timing but use a timing wheel composed of plastic components and rubber seals that are not prone to change of adjustment, moisture freezing, and do not allow out of range max or min settings that can cause the unit to hold open.
- E. The Controller shall have passages and chamber sizes to allow water to pass through if present, and not hold open for unacceptable lengths of time while passing water.
- F. The Controller shall have vacuum passages that are designed to drain moisture from chambers, which prevents possibility of held moisture from freezing.
- G. The Controller air passages shall be designed to reduce likelihood of water being pulled into controller.
- H. The Controller shall be serviceable by factory-trained personnel and shall be removable from the valve by means of a sliding key device. There shall be no tools required to remove and replace the controller from the vacuum valve with the exception of tubing clamp nut drivers.
- I. The Controller shall be easily fully functional tested to determine any leaking internal seals and to guarantee consistent quality. This shall be done by manufacturer production and during operator re-build.
- J. The Controller body end pieces shall be constructed to allow visual inspection for moisture and to determine operation position without disassembly.
- K. Each vacuum valve controller shall be equipped with a port for connecting a portable, self-contained valve cycle counter.

- L. The Controller shall be chemically resistant to sewage and sewage gases, including bleach (used as disinfectant) and sulfuric acid (from septic sewage). Controllers shall be constructed from materials described in the following table.

COMPONENT	MATERIAL
Controller Body, Clear End Parts	Clear Nylon 12
Controller Body, Blue Parts	Polypropylene
Controller Shaft, Small parts	Polypropylene
Controller Springs	316 Stainless Steel
Controller O-Rings	Silicon Rubber, Buna N Rubber
All metal Fasteners	316 Stainless Steel

- J. The Controller shall provide for manual activation by using an activation tool. The activation design shall not expose any rubber components that can be damaged or deteriorate and prevent controller operation.

K. Manufacturer: Airvac HP Controller as manufactured by Airvac

2.11 IN-SUMP BREATHER:

- A. With the exception of the individual house 4" gravity line air intake (or the 6" Air Terminal, if used), there shall be no other external sources of air necessary or permitted as a part of this assembly.
- B. A factory provided internal sump breather unit arrangement shall connect the controller to its air source and provide a means of assuring no liquid can enter the controller during system shutdowns and re-starts.
- C. The sump breather shall install into a breather pipe fitting that mounts through a grommet in the sump pit bottom. The sump breather shall be activated by pressure building in the breather pipe only when high sewage level occurs. The pressure then causes the sump breather to switch to the closed position and protect water from getting to the controller or valve.
- D. The internal sump breather shall be arranged to prevent sump pressure from forcing the valve to open during low vacuum conditions and provide positive sump venting regardless of traps in the home gravity service line. The tubing connection arrangement provides a floating check valve to vent any sump pressure but not discharge any sewage into valve pit.
- E. The internal sump breather shall be arranged to ensure proper valve opening by preventing vacuum to be present in the valve lower housing when the sump breather is in the closed position and the valve is attempting to open. This shall be done by an air inlet check valve in the tubing connection that will admit air from the valve pit to release any vacuum in the valve lower housing.

- F. Breather high sewage level switch: The breather position switch shall be IP67 rated and shall be internally installed in the sump breather. The breather high sewage level switch shall not use a floating switch in the sewage sump. Breather position switches that require the use of magnetic sensors are prohibited.
- G. Lower housing electrical connections: An IP68 rated thermoplastic electrical connection shall be installed into the sump breather housing. Connection contacts shall be gold plated and supplied with a rubber cover plug. Connectors shall have molded-in elastomer seal faces. Loose O-rings are prohibited. All electrical connections shall be epoxy encapsulated or plastic over-molded.
- H. Manufacturer: In-sump breather SBPA as manufactured by Airvac.

2.12 6" MOLDED AIR-TERMINAL

- A. Complete Air-Terminal: One 6" air-terminal assembly as shown on the standard details shall be connected to each valve pit sump through one of the four (4) sump openings provided. Connecting any gravity inlet piping to the air-terminal is not permitted.
- B. Height: The air-terminal's slotted door shall be above the highest expected water level as shown on the standard details. The molded air-terminal is intended to be installed flush with the ground but may be partially buried up to a maximum of 12 inches.
- C. Piping: 6" PVC pipe as described Part 2 "Products" shall be used to connect the air terminal to the valve sump.
- D. Molded Air-Terminal: Molded polyethylene construction with approximately 3/16" wall thickness. Equipped with a 6" pipe grommet for sealing against ground water intrusion and a 6.4" x 8.8" hinged door. Standard color Simulated Brown Stone.
- E. Support: This product is intended to be self supporting but may also be attached to a permanent structure is so desired.
- F. Manufacturer: Molded Air-terminal AT1000-1 as manufactured by Airvac.

2.22 3" PIPE COUPLING:

- A. 3-inch pipe coupling: Complete assembly shall be composed of a plastic hinged clamp, rubber sleeve, and worm gear clamp all of which shall be chemically resistant to sewage. Assembly to hinge open for easy installation when coupling the 3" interface valve to the suction line and the outgoing 3" vacuum service line. No-hub coupling and Fernco couplings are not allowed.
- B. Plastic clamp portion: Shall be composed of 2 pieces of glass filled polypropylene and a 0.30" thick walled band for heavy duty clamping.
- C. Rubber sleeve: Shall be manufactured from Buna-N rubber with a wall thickness of 0.125" and a length of 3" with a center stop ring.
- D. Worm gear clamp, screw, and housing: Shall be 316 stainless steel and rated for 60 in-lb clamping torque.
- E. Manufacturer: Pipe Coupling as manufactured by Airvac.

DIVISION 2 - SITE WORK

SECTION 02730 - UNDERGROUND VACUUM SEWER PIPING

PART 3 - EXECUTION

3.1 TRENCHING:

- A. See separate section.

3.2 DEWATERING:

- A. Under provisions of the section covering trenching.

3.3 VACUUM SEWER LINE INSTALLATION

- A. All vacuum sewers shall be laid to the line and grade with the use of construction laser beam equipment. All pipe which has been designed to slope downward shall be installed to slope continuously downward. There shall be no abrupt sags or bellies in the line. The maximum deviation from planned elevations shall not exceed 0.05 feet in any 100 feet of length. This plus or minus tolerance applies to all pipe sizes.
- B. Installation by the horizontal directional drilling (HDD) method is not acceptable, unless prior, written approval is obtained from the ENGINEER. Approval would be on a case-by-case basis. Request to use HDD is a major deviation requiring different pipe materials, joints, etc. Should ENGINEER approve the use of HDD, the installation tolerances specified in Section 3.3.A for open-cut would apply, no abrupt sags or bellies are allowed, and the CONTRACTOR shall verify such through electronic means while the pipe is being installed.
- C. Use proper tools and appliances for handling and laying of pipe and fittings.
- D. Prevent entrance of dirt or foreign matter or damage to pipe lining or coating. Plug the pipe any time that work is stopped.
- E. Do not allow trench water to enter the pipe at any time.
- F. No defective pieces are permitted. Defective pieces discovered after use will be removed and replaced with a sound piece.
- G. Fully bare pipe along its entire length.
- H. Lay and join pipe in accordance with manufacturer's instructions to insure pipe thermal expansion and contraction. Lay pipe with spigot end down stream.
- I. Place compacted fill in entire space between the fitting and the trench walls.
- J. Use temporary plugs in end of pipes when work is not in progress.

- K. Provide pipe through casing with support skids to hold pipe to center of casing as shown on Detail Drawings. Alternate support methods acceptable contingent upon ENGINEER's review.
- L. Bed pipe as specified in section describing trenching.
- M. Verify pipe grade and elevation at each change in grade and record in notebook in a manner acceptable to the ENGINEER.

3.4 DIVISION VALVE AND GAGE TAP INSTALLATION:

- A. Furnish and install valves per provisions of Paragraph 2.3 of this section.
- B. Install division valve as shown on the standard detail.
- C. Install gage tap adjacent to division valve as shown on the standard detail.

3.5 VALVE PIT INSTALLATION - GENERAL

- A. The end of the stub-out pipe that passes through the gravity line valve pit grommet shall be beveled. A stop ring shall be used to ensure the pipe does not protrude more than 4" inside the collection sump with an allowable tolerance of $\pm 1/8"$.
- B. All pipes that penetrate the valve pit through grommets shall be as described in Part 2 "Products". No other pipe is acceptable.
- C. The type of lubrication used with Airvac grommets and twist lock hole seals shall be as specified in Part 2.4.E.

3.6 VALVE PIT INSTALLATION (2-PIECE PITS)

- A. Valve pits shall be assembled in accordance with manufacturer's instructions.
- B. Valve pits shall be installed using the following procedures:
 - 1. Install the suction and sensor pipes.
 - 2. Determine proper location and alignment with vacuum main and wye connection.
 - 3. Determine grade elevation for the top of the pit package.
 - 4. Determine the gravity line depth from the home to the pit package and verify that adequate slope exists between the house and the

sump inlet. If sufficient fall does not exist, consult the ENGINEER or inspector prior to completing the valve pit installation.

5. Determine which raised flat area of the sump will require a gravity line stub out. Mark and cut the holes in the raised flat area as required. Each coupon shall be removed from the hole saw and hung inside the upper chamber as proof of its removal.
 - a) For 4" laterals, a 5" opening is required with the centerline of the opening 18" from the outside bottom of the sump.
 - b) For 6" laterals, a 6-7/8" opening is required with the centerline of the opening 19" from the outside bottom of the sump.
6. Install the appropriate size Airvac rubber grommets into the field cut holes.
7. Excavate and prepare the bedding for the valve pit package as shown on construction plans or as field instructed.
8. Lower the collection sump assembly into the prepared excavated hole, taking care that no material enters the collection sump.
9. Install the prefabricated house gravity line stub-outs through the grommet into the collection sump tank with the stop coupling firmly against the grommet. Use lubricant as specified in Part 2.5.E when installing the stub outs. Ensure that grommet remains in place after pipe stub is installed.
10. Level entire assembly.
11. Backfill to the top of the collection sump. Compact the soil per the ENGINEER's requirements.
12. Conduct the sump pressure test as described in Sect 3.8.
13. Keep all mating surfaces clean and dry. Place the valve pit on top of the sump.
14. Re-check level of valve pit package. Use of hydraulic machinery to obtain final level of valve pit may result in sump damage and is strictly prohibited.
15. Install the anti-buoyancy collar
16. Insert the beveled end of the Airvac 3" flexible connector into the 3" pit opening hole. Push flexible connector all the way to the 3" suction elbow.
17. Use a 3" PVC coupling to attach the end of the flexible connector to the suction elbow (do not glue) to insure proper alignment.

18. After bedding the flexible connector, backfill to the top of the valve pit package. Compact the soil per the ENGINEER's requirements.
19. Remove the 3" coupling and cut the PVC end of the flexible connector to the center of the pit package (+/-1"). This is the only time the flexible connector may be cut during installation. The flexible connector must remain aligned concentrically with the suction pipe +/-1/2" after cutting.
20. Glue a PVC cap onto the end of the 3" flexible connector inside the pit package. **NOTE:** It is important to glue the PVC cap onto the end of the flexible connector prior to any vacuum being applied to the 3" vacuum service lateral. Failure to do this may result in the collapse of the lower collection sump.
21. Place the frame and cover on top of the valve pit assembly.
22. Pour a concrete ring, when required by ENGINEER.
23. Complete the installation of vacuum service piping from end of the flexible connector to the wye connection at vacuum main. Ensure downward slope from pit to main and any lifts required meet design requirements.
24. Complete the back-fill of the service lateral (flexible connector to main line wye). Tamp or vibrate fill.
25. Record information on the Valve Pit Installation Form.

3.8 AIRVAC SUMP TESTING - 2-PIECE PITS

- A. One sump test shall be performed. This test is performed after all holes have been field cut, grommets and stub-out pipes have been installed and the entire valve pit assembly installed in the ground. This test is done to test the grommets, the entire length of the stub-outs including any pipe in the public right-of-way, and the overall sump assembly.
- B. Sump testing shall be done as follows:
 1. Attach provided sump test assembly onto the end of the 3" suction pipe inside the valve pit with a 3" No-hub or Fernco coupling and PVC test cap.
 2. Secure 1/8" tubing to the HIGH port on a 0-50" magnehelic gauge, and then connect the other end to the tubing port on the PVC test cap.

3. Install a test plug in the sump breather hole using the rubber seal provided. Apply water soluble soap to the rubber seal before installation. Turn 90 degrees to make a tight seal.
4. Pressurize the collection sump through the air chuck on the PVC test cap.
5. Test at 40" water gauge pressure. Leakage must be under 5" water gauge in one (1) minute.
6. If leak test fails the CONTRACTOR must locate the leak, repair it and retest.

3.13 BACKFILLING

- A. See Trenching

3.15 VACUUM LINE TESTING – DAILY TESTING

- A. A two (2) hour vacuum tightness test of all sewer mains and lateral connections shall be conducted daily as follows:
 1. Plug all open connection with rubber stoppers or temporary caps, fitted to the pipe by "no-hub" couplings.
 2. Apply a vacuum to 22 inches Hg to the pipes and allow the pressure to stabilize for 15 minutes (if data logger is used, apply vacuum of -0.73 bar).
 3. There shall be no loss of vacuum in excess of ½ inch Hg over a two-hour test period (if data logger is used, no loss in excess of 0.02 bar. Passing test is a reading anywhere between -0.73 and -0.71 bar).
 4. There shall be absolutely no water allowed to be admitted into the piping network during this test.
 5. The daily test shall include the new section of pipe laid that day in addition to all pipe connected to the same vacuum main that was laid and tested previously.
- B. If the CONTRACTOR successfully passes the daily 2-hour test for seven (7) consecutive working days or two thousand (2,000) feet of pipe, a request to modify the test procedures may be made to the ENGINEER. If so approved by the ENGINEER, the daily two (2) hour vacuum test procedure may be modified as follows:

1. The procedure may be altered to relax the requirement for daily testing with testing done in the intervals deemed necessary by the CONTRACTOR and approved by the ENGINEER.
2. Should a line fail the vacuum test while utilizing this test modification, the CONTRACTOR shall take whatever action necessary at his own expense to successfully pass the test including the re-excavation of the trench, leak detection, line repair, and additional cleanup as required by the ENGINEER.
3. After a failure, the CONTRACTOR must return to the standard testing procedures to "re-qualify" for the modified testing.
4. This test modification is optional, and as such, the CONTRACTOR assumes all liability in its use, even if approved by the ENGINEER.

3.16 VACUUM LINE TESTING – FINAL ACCEPTANCE TEST

- A. A four (4) hour vacuum tightness test of the complete vacuum piping network, including all sewer mains and lateral connections shall be conducted as follows:
 1. Subject the entire sewerage system to a vacuum of 22 inches Hg and allow to stabilize for 15 minutes (if data logger is used, apply vacuum of -0.73 bar).
 2. There shall be no loss greater than 1-inch Hg over a four (4) hour test period (if data logger is used, no loss in excess of .04 bar. A passing test is a reading anywhere between -0.73 and -.069 bar).
 3. There shall be absolutely no water allowed to enter the piping system or the vacuum station during this test.
- B. CONTRACTOR to provide 48 hours notice to ENGINEER prior to test.
- C. CONTRACTOR to assure all division valves are open prior to beginning of Final Acceptance Test.
- D. Final Acceptance Test shall be recorded on approved vacuum chart recorder. This chart will not be considered valid unless witnessed by ENGINEER on test equipment at beginning and the end of vacuum test period.
- E. ENGINEER will sign and date chart to verify witness of test. This signature does not indicate acceptance of the system.

3.17 LINE FLUSHING

- A. After successful final four (4) hour acceptance testing, flush lines to remove debris and foreign materials that accumulated during construction.

- B. Suggested procedure (In the absence of special test apparatus, this procedure will require the use of vacuum valves, which must be installed by the OWNER. Coordination is therefore required.):
1. Place system under vacuum.
 2. Add water and air in controlled amounts to valve pits at extreme ends of system.
 3. Utilize system vacuum to transport water and debris to collection point.
 4. Continue procedure until water entering at collection point is free of contamination or debris.
 5. If the vacuum collection tank is used as the collection point, monitor volume of liquid in tank and pump out as necessary.
 6. Use system sewage pumps only after verifying that no debris is present in collection tank.
 7. If debris is present, use other methods to empty collection tank.
 8. At completion of flushing, clean collection tank of all collected debris.
 9. Seal system and make ready to place into operation.
- C. Alternate flushing procedure subject to ENGINEER's review and approval.

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section specifies all labor, materials and equipment necessary for providing and installing formwork for concrete.
- B. Related Work Described Elsewhere:
 - 1. Section 03200 "Concrete Reinforcement"
 - 2. Section 03300 "Cast-in-Place Concrete"
- C. General Design: The Contractor shall be responsible for the design of all formwork and for safety in its construction, use and removal.

1.02 QUALITY ASSURANCE

- A. Qualifications: Formwork shall be constructed in accordance with the specified standards, as well as all pertinent codes and regulations. In cases where requirements of pertinent codes conflict with the requirements of these specifications, the more stringent shall govern.
- B. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:
 - 1. Standard Building Code
 - 2. ACI 347 "Recommended Practice for Concrete Formwork"
 - 3. Local codes and regulations

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the OWNER/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Materials: Submit manufacturer's literature on form ties, spreaders, corner formers, form coatings and bond breakers.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Form Lumber: Use form lumber when in contact with exposed concrete, conforming to

the following or acceptable equivalent.

B. Lumber: Douglas Fir/Larch No. 2 grade, seasoned, surfaced on four sides.

C. Plywood: "Plyform", Class I or II, bearing the label of the Douglas Plywood Association. (Minimum 3/4-inch thickness).

D. Form Ties: Use form ties which do not leave an open hole through the concrete and which permit neat and solid patching at every hole. Use embedded rods with integral hydrophilic rubber sealing and expanding waterstops and cones to provide a 1-inch breakback. Wire ties and wood spreaders will not be permitted.

E. Form Coatings: Form release coating shall be a paraffin base oil or mineral oil coating which effectively prevents absorption of moisture; prevents bonding with concrete; is non-staining to concrete; and leaves the concrete with a paintable surface.

F. Chamfer Strips: Chamfer strips shall be polyvinyl strips or acceptable equal, designed to be nailed in the forms to provide a 3/4-inch chamfer (unless indicated otherwise) at exposed edges of concrete members.

G. Waterstops

A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricates corners, intersections, and directional changes.

1. Profile: Ribbed

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Rubber Waterstops:

a. Greenstreak.

b. Progress Unlimited Inc.

c. Westec Barrier Technologies; Div. of Western Textile Products, Inc.

d. Williams Products, Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Construction of Formwork: Forms shall be sufficiently strong to withstand the pressure resulting from the placement and vibration of concrete and shall be sufficiently rigid to maintain specified tolerances. Forms shall be sufficiently tight to prevent loss of mortar, and shall be adequately braced against lateral, upward or downward movement.

B. Coating of Forms: Apply form coating to board forms prior to placing reinforcing. Keep form coatings off steel reinforcing, items to be embedded, and previously placed concrete.

C. Form Erection:

1. Provide a means of holding adjacent edges, ends of panels, and ends of sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects of the finished concrete. Insure that forms may be removed without damage to the surface of the finished concrete.
2. Provide a positive means of adjustment of shores and struts. Insure that all settlement is taken up during concrete placing.
3. Temporary openings shall be provided in wall forms to limit the free fall of concrete to a maximum of 6-feet unless an elephant trunk is used. Such openings shall be located to facilitate placing and consolidation and shall be spaced no more than 8-feet apart. Temporary openings shall also be provided in the bottom of the wall, column forms, and elsewhere as necessary to facilitate cleaning and observation immediately prior to placing.
4. Do not embed any form-tying device or part thereof other than metal in concrete.
5. Form surfaces of concrete members except where placement of the concrete is against the ground. The dimensions of concrete members shown on the Drawings apply to formed surfaces, except where otherwise indicated.

D. Form Reuse: Reuse only forms which maintain a uniform surface texture on exposed concrete surfaces. Apply light sanding between uses to obtain such a uniform texture. Plug unused tie rod holes with corks, shave flush, and sand the concrete surface side of the plug.

E. Formed Openings: Openings shall be of sufficient size to permit final equipment alignment without deflection or offsets of any kind. Where the items pass through the wall, allow space for packing to ensure water tightness. Provide openings with continuous keyways with waterstops where required. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide reinforcement as indicated and specified. Reinforcing steel shall be at least 2-inches clear from the opening.

F. Embedded Items: Set anchor bolts and other embedded items accurately and hold securely in position in the forms until the concrete is placed and set. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concrete pour. Check all nailing, blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work prior to concrete pour.

G. Pipes and Wall Spools Cast in Concrete

1. Install wall spools, wall flanges, and wall anchors before placing concrete. Do not weld, tie or otherwise connect the wall spools to the reinforcing steel.
2. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will be possible during Construction.

H. Form Tolerances

1. Failure of the forms to produce the specified concrete surface tolerance shall be grounds for rejection of the concrete work. Rejected Work shall be repaired or replaced at no cost to the OWNER.
2. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

	Maximum Tolerance
Sleeves and inserts	+1/4-inch to -1/4-inch
Projected ends of anchors	+1/4-inch to -0.0-inch
Anchor bolt setting	+1/4-inch to -1/4-inch
Finished concrete	+ 1/4-inch to -1/4-inch in 10 feet of length

The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and inserts	Centerline of sleeve or insert
Projected ends of anchors	Plane perpendicular to the end of the anchor as located on the Drawings
Anchor bolt setting	Centerline of anchor bolts
Finished concrete	The concrete surface as located on the Drawings

3. Where equipment is to be installed, comply with manufacturer's tolerances if more stringent than above.

3.02 REMOVAL OF FORMS

- A. The Contractor shall be responsible for all damage resulting from removal of forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 301 and ACI 347. Form removal shall conform to the requirements specified in Section 03300, Cast-In Place-Concrete.

3.03 INSPECTION

- A. The Engineer on site shall be notified when the forms are complete and ready for inspection at least 6 hours prior to the proposed concrete placement.
- B. Failure of the forms to comply with the requirements specified herein or to produce concrete complying with requirements of Section 03300, Cast-In-Place Concrete, shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of this Section and approval of the Engineer.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section specifies reinforcing steel and welded wire mesh for cast-in-place or precast concrete structures.
- B. Related Work:
 - 1. Section 03100 "Concrete Formwork"
 - 2. Section 03300 "Cast-in-Place Concrete"
 - 3. Section 03410 "Precast Concrete Structures"

1.02 QUALITY ASSURANCE

- A. Standards: Unless otherwise indicated, all materials, workmanship, and practices shall meet all requirements of the current editions of the following standards:
 - 1. Standard Building Code
 - 2. ACI 318 Building Code Requirements for Reinforced Concrete
 - 3. ACI 315 Details and Detailing of Concrete Reinforcement
 - 4. CRSI Manual of Standard Practice, MSP-2

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the OWNER/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Complete shop drawings shall be submitted for comment, including bar lists and placing drawings. Drawings shall show the type, spacing, and location of metal bar supports, the grade of the reinforcing and the name of the manufacturer. The type of coupler splice devices shall be designated.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed billet steel bars of a USA manufacturer.
- B. Welded Wire Fabric: ASTM A185, galvanized.
- C. Metal Bar Supports: CRSI MSP-2, Chapter 3, Class 2, Type B, Stainless Steel Protected Bar Supports.
- D. Coupler Splice Devices: Cadweld tension couplers capable of developing the ultimate

strength of the bar, as manufactured by Erico Products, Incorporated, Solon, Ohio, or equal where acceptable to the OWNER.

2.02 FABRICATION

- A. Fabrication shall meet all requirements of the specified standards. Unless otherwise indicated, the following shall apply:
 - 1. Hooks shall be standard hooks.
 - 2. Bottom bars shall extend a minimum of 6-inches into supporting members.
 - 3. Minimum cover shall be measured to the outermost stirrup, tie or bar.
 - 4. Splices are permitted only where indicated on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Supporting Reinforcing: Bar supports shall be provided as required by CRSI MSP-2 and ACI 315. Top and bottom bars in slabs formed on earth shall be supported on precast concrete block supports except where such bars are properly supported from formwork. Precast concrete block supports are not required in slabs formed on tremie concrete but may be used at the Contractor's option.
- B. Placing Reinforcing: Placing of reinforcing steel and welded wire fabric shall conform to CRSI MSP-2, ACI 315, and the Drawings. Reinforcing shall be securely tied and supported to prevent displacement during concrete placement.
- C. Welded Wire Fabric: Splices in welded wire fabric shall be such that the overlap between outermost cross wires of each fabric sheet is not less than the spacing of the cross wires, plus 2-inches. Fabric shall not be extended through expansion joints or construction joints in slabs on grade except as otherwise indicated on the Drawings.
- D. Coupler Splice: Unless indicated on the Drawings or where conventional lap splices cannot be achieved, full positive tension connections shall be provided. Such devices shall be installed in accordance with the recommendations of the manufacturer.
- E. Dowels: Dowels shall be wired in position prior to placing concrete.
- F. Field Bending: Heat shall not be used to bend bars. Bars shall not be bent after being embedded in concrete.
- G. Welding: Welding of reinforcing will not be permitted.
- H. Place reinforcement a minimum of 2-inches clear of any metal pipe or fittings.

END OF SECTION

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SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: This Section specifies cast-in-place concrete including all materials, mixing and transport, and performing all labor for the proportioning, mixing, transporting, placing, consolidating, finishing, and curing of concrete.

B. Related Work Described Elsewhere:

1. Section 03100 "Concrete Formwork"
2. Section 03200 "Concrete Reinforcement"

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the requirements of the following standards:

1. Standard Building Code
2. Local Codes and Regulations
3. ACI 318-83, Building Code Requirements for Reinforced Concrete

B. Plant Qualification: Plant equipment and facilities shall meet all requirements of the checklist for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C 94.

C. Evaluation and Acceptance of Concrete: Evaluation and acceptance of concrete will be in accordance with ACI-318, Chapter 4.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the OWNER for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

B. Materials and Shop Drawings: The following information shall be submitted for review. No concrete shall be furnished until the OWNER has reviewed submittal and no exceptions taken or other favorable response has been returned.

1. Plant Qualification: Satisfactory evidence shall be submitted indicating that the plant and operators have sufficient experience in providing the applicable design mix.

2. Materials: Satisfactory evidence shall be submitted indicating those materials to be used (including cement, aggregates and admixtures) meet the specified requirements.
3. Design Mix: The design mix to be used shall be prepared by qualified persons and submitted for review. Submit affidavit as to design mix performance over the preceding 6-months. The design of the mix is the responsibility of the Contractor subject to the limitations of the Specifications. Acceptance of this submission will be required only as minimum requirements of the Specifications have been met. Such acceptance will in no way alter the responsibility of the Contractor to furnish concrete meeting the requirements of the Specifications relative to strength and slump.
4. Ready Mix Concrete: Provide delivery tickets or weigh master's certificate per ASTM C 94, including weights of cement and each size aggregate, amount of water in the aggregate, and amount of water added at the plant. The amount of water added on the job shall be written on the ticket.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement

1. Cement for all concrete shall be domestic Portland cement that conforms to the requirements of ASTM Designation C 150 Type I, Type II or Type III. All sanitary sewer manholes, wetwells, pumping stations, tanks and structures exposed to wastewater shall be constructed with Type II cement. Type III cement for high early strength concrete shall be used only for special locations and only with the review and acceptance of the OWNER. Type I cement may be used for buildings and tremie concrete.
2. Only 1 brand of cement shall be used in any individual structure unless acceptable by the OWNER. Cement that has become damaged, partially set, lumpy or caked shall not be used and the entire contents of the sack or container that contains such cement will be rejected. No salvaged or reclaimed cement shall be used.
3. Fly ash shall not be used in either Class A or Class B concrete.

B. Aggregates:

1. ASTM C 33. Coarse aggregates shall be size No. 57. Block cell fill shall be size No. 89.
2. In addition to requirements of ASTM C 33 for structures exposed to wastewater, the following shall apply:
 - a. Soft particles: 2% (2.0 percent)
 - b. Chert as a soft impurity (defined in Table 3 of ASTM C 33): 1% (1.0 percent)
 - c. Total of soft particles and chert as a soft impurity: 2% (2.0 percent)
 - d. Flat and elongated particles (long dimension > 5 times short dimension): 15%.

C. Water: Clean and free from injurious amounts of deleterious materials.

D. Air Entraining Admixture: ASTM C 260.

E. Water Reducing and Retarding Admixture: ASTM C 494, Type D. Admixture shall not contain calcium chloride.

F. Epoxy Bonding Agent: Sikastix 370, Sikadur Hi Mod, Concresive 1001-LPL or acceptable equal.

G. Waterproofing Material: Concrete admixture shall be manufactured and supplied by an approved manufacturer as shown in the Drawings.

2.02 MIXES

A. General Requirements

1. Mix Design: Proportioning shall be on the basis of field experience and/or trial mixtures as specified in ACI 318, Section 4.3. Data on consecutive compression tests and standard deviation shall be submitted. Proportioning for small structures may be by the water/cement ratio under special review and acceptance by the OWNER. Concrete mix design shall comply with the Standard Building Code requirements.
2. Air Content: 5% plus or minus ($\pm$) 1% (Class A and B).
3. Slump: 4-inches plus or minus ($\pm$) 1-inch. 8-inches plus or minus ($\pm$) 1-inch for tremie concrete.
4. Water/cement ratio = 0.45 maximum (all concrete exposed to hydrostatic loading), 0.50 maximum (all other concrete).
5. Minimum Compressive Strength at 28-days
 - a. Class A, 5,000-psi: Water and wastewater structures inclusive of tanks, ditches, pumping stations, tremie concrete and other structures in contact with process water.
 - b. Class B, 3,000-psi: Building structures, curb and gutters, slabs, walks, encasements, thrust blocks, and pipe supports, etc. not in contact with process water.
 - c. Class C, 2,500-psi: Mix wherever specified in the standard drawings

B. Production of Concrete

1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise indicated.
2. Air Entraining Admixture: Air entraining admixture shall be charged into the mixture as a solution and shall be measured by means of an acceptable mechanical dispensing device. The liquid shall be considered a part of the mixing water.

3. Waterproofing admixture: New concrete structures shall contain a crystalline waterproofing concrete admixture. Crystalline waterproofing concrete admixture shall be added to the concrete during the batching operation. The admixture concentration shall be added based upon manufacturer design percent concentration of admixture to the required weight of cement. The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the admixture was added to the concrete for all precast structures. Colorant shall be added and provided at the admixture manufacturing facility, not at the concrete batch plant. It is recommended that the admixture be added first to the rock and sand and blended thoroughly before adding cement and water or per the manufacturer's recommendations. Concrete structures without crystalline waterproofing admixture or admixture without colorant for field verification shall be rejected. Contractor shall provide certification the admixture was installed in accordance with the manufacturer's recommendations.
4. Water Reducing and Retarding Admixture: Water reducing and retarding admixture shall be added and measured as recommended by the manufacturer. The addition of the admixture shall be completed within 1-minute after addition of water to the cement has been completed, or prior to the beginning of the last 3/4 of the required mixing, whichever occurs first. Admixtures shall be stored, handled and batched in accordance with the recommendations of ACI 68.

C. Delivery Tickets: In addition to the information required by ASTM C 94, delivery tickets shall indicate the cement content and the water/cement ratio.

D. Temperatures: The temperature of the concrete upon delivery from the truck shall not exceed 90° F.

E. Modifications to the Mix: No modifications to the mix shall be made in the plant or on the job which will decrease the cement content or increase the water/cement ratio beyond that specified.

PART 3 - EXECUTION

3.01 PREPARATION

A. Preparations before Placing: No concrete shall be placed until the review and acceptance of the OWNER has been received. Acceptance will not be granted until forms are clean and reinforcing and all other items required to be set in concrete have been placed and thoroughly secured. The OWNER shall be notified a minimum of 24-hours before concrete is placed.

B. Conveying:

1. General: Concrete shall be handled from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete. No concrete shall be placed more than 90-minutes after mixing has begun for that particular batch.

2. Buckets and Hoppers: Buckets and hoppers shall have discharge gates with a clear opening equal to no less than 1/3 of the maximum interior horizontal area, or 5 times the maximum aggregate size being used. Side slopes shall be no less than 60° (degrees). Controls on gates shall permit opening and closing during the discharge cycle.
3. Runways: Extreme care shall be exercised to avoid displacement of reinforcing during the placing of concrete.
4. Elephant Trunks: Hoppers and elephant trunks shall be used to prevent the free fall of concrete of more than 6-feet.
5. Chutes: Chutes shall be metal or metal lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-feet long and chutes not meeting the slope requirements may be used only if they discharge into a hopper before distribution.
6. Pumping Equipment: Pumping equipment and procedures shall conform to the recommendations contained in the report of ACI Committee 304 on "Placing Concrete by Pumping Methods," ACI 304.2R-71. The specified slump shall be measured at the point of discharge. The loss of slump in pumping shall not exceed 1-1/2-inches.
7. Conveying equipment Construction: Aluminum or aluminum alloy pipe for tremies or pump lines and chutes, except for short lengths at the truck mixer shall not be permitted.
8. Cleaning: Conveying equipment shall be cleaned at the end of each concrete operation.

3.02 APPLICATION

A. Placing:

1. General: Concrete shall be deposited continuously, or in layers of such thickness (not exceeding 2-feet in depth) that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness.
2. Supported Elements: At least 2-hours shall elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon.
3. Segregation: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to procedures that will cause segregation.
4. Concrete Underwater: All concrete, except that indicated on the Drawings as tremie concrete, shall be placed in the dry.

B. Seals and Tremie Concrete

1. General
 - a. Wherever practicable, all foundation excavations shall be dewatered and the concrete deposited in the dry. Where conditions are encountered which render it impracticable to dewater the foundation before placing concrete, a concrete foundation seal shall be placed. The foundation shall then be dewatered, and the balance of the concrete placed in the dry.

- b. When seal concrete is required to be placed, the satisfactory performance of the seal in providing a watertight excavation for placing structural concrete shall be the responsibility of the Contractor. Seal concrete placed by the Contractor, which subsequently fails to perform properly, shall be repaired as necessary to perform its required function, at the expense of the Contractor.
 2. Method of Placing: Concrete deposited underwater shall be carefully placed in the space in which it is to remain by means of a tremie, a closed-bottom dump bucket of not less than 1-cubic yard capacity, or other approved method, and shall not be disturbed after it is deposited. All seal concrete shall be deposited in 1 continuous pour. No concrete shall be placed in running water. All formwork designed to retain concrete underwater shall be watertight, and the design of the formwork and excavation sheeting shall be by a Professional Engineer, registered in the State of Florida.
 3. Use of Tremie: The tremie shall consist of a tube having a minimum inside diameter of 10-inches, and shall be constructed in sections having tight joints. No aluminum parts that have contact with the concrete will be permitted. The discharge end shall be entirely seated at all times, and the tremie tube kept full to the bottom of the hopper. When a batch is dumped into the hopper, the tremie shall be slightly raised (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper, after which the flow shall be stopped by lowering the tremie. The means of supporting the tremie shall be such as to permit the free movement of the discharge end over the entire top surface of the Work, and shall permit it being lowered rapidly when necessary to choke off or retard the flow. The flow shall preferably be continuous, and in no case shall be interrupted until the Work is completed. Special care shall be exercised to maintain still water at the point of deposit.
 4. Use of Bottom-dump Bucket: When the concrete is placed by means of a bottom-dump bucket, the bucket shall be lowered gradually and carefully until it rests upon the concrete already placed. The bucket shall then be raised very slowly during the discharge travel; the intent being to maintain, as nearly as possible, still water at the point of discharge and to avoid agitating the mixture. Aluminum buckets will not be permitted.
 5. Time of Beginning Pumping: Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure, and in no case earlier than 72-hours after placement of the concrete.
- C. Consolidating Concrete:
1. General: Concrete shall be consolidated by means of internal vibrators operated by competent workmen.
 2. Vibrators: Vibrators shall have a minimum head diameter of at least 2-inches, a minimum centrifugal force of 700-pounds and a minimum frequency of 8,000 vibrations per second.
 3. Vibrators for Confined Areas: In confined areas, the specified vibrators shall be supplemented by others having a minimum head diameter of 1-1/2-inches, a minimum centrifugal force of 300-pounds and a minimum frequency of 9,000 vibrations per second.

4. Spare Vibrator: One (1) spare vibrator for each 3 in use shall be kept on the site during all concrete placing operations.
5. Use of Vibrators: Vibrators shall be inserted and withdrawn at points approximately 18-inches apart. The duration of each insertion shall be from 5 to 15-seconds. Concrete shall not be transported in the forms by means of vibrators.

D. Protection: Rainwater shall not be allowed to increase the amount of mixing water, or to damage the surface finish. Concrete shall be protected from construction over-loads. Design loads shall not be applied until the specified strength has been attained.

3.03 CONCRETE FINISHING AND CURING

A. All slabs exposed to view shall receive a steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.

B. All other slabs and footings shall receive a smooth steel trowel finish.

C. All walls of structures or parts of buildings exposed to view shall receive the following:

1. Repair defective concrete, remove fins, fill depressions 1/4-inch or deeper, and fill tie holes.
2. Any surface not receiving a special applied finish, shall receive a slurry finish consisting of 1 part cement and 1-1/2 parts sand by damp loose volume. Dampen surfaces and then apply the slurry with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.
3. Surfaces that will receive a special applied finish shall be of even color, have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff bristle fiber brush shall produce no dusting or dislodging of cement or sand.

D. Curing Methods

1. All concrete shall be wet cured a minimum of 7-days. Cure concrete to retain moisture and maintain specified temperature at the surface.
 - a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling or covered with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.
2. Specified applications of curing methods.
 - a. Structural Slabs, Slabs on Grade and Footings: Water curing
 - b. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used.

E. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

F. All surface defects shall be repaired by removing defective concrete down to sound concrete and repairing with patching mortar and bonding agent. Finished repair shall match adjacent concrete and be cured as specified.

G. Cold Weather Concreting

1. "Cold weather" is defined as a period when for more than 3 successive days, the average daily outdoor temperature drops below 40 degrees F. The average daily temperature shall be calculated as the average of the highest and the lowest temperature during the period from midnight to midnight.
2. Cold weather concreting shall conform to ACI 306.1 and the additional requirements specified herein. Temperatures at the concrete placement shall be recorded at 12-hour intervals (minimum).
3. Discuss a cold weather work plan with the Engineer. The discussion shall encompass the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete.

H. Hot Weather Concreting

1. "Hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lbs/sqft/hr).
2. Concrete placed during hot weather, shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R and the additional requirements specified herein.
 - a. Temperature of concrete being placed shall not exceed 90 degrees F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints.
 - b. All necessary precautions shall be taken to promptly deliver, to promptly place the concrete upon its arrival at the job and to provide vibration immediately after placement.
 - c. The Engineer may direct the Contractor to immediately cover plastic concrete with sheet material
3. Discuss with the Engineer a work plan describing the methods and procedures proposed to use for concrete placement and curing during hot weather periods. Hot weather concreting shall not begin until the work plan is acceptable to the Engineer.

3.04 TESTING

A. A testing laboratory, acceptable to the OWNER, shall perform required testing. The Contractor shall pay for all tests to comply with the Specifications. The Contractor shall keep the laboratory informed of his schedule. The contractor shall provide the Engineer with testing results as they are made available.

B. Standard laboratory compressive test cylinders shall be obtained by the laboratory when concrete is discharged at the point of placing (i.e., discharge end of pumping equipment), and cylinders shall be made and cured in accordance with the requirements of ASTM Designation C 31. A set of 4 cylinders shall be obtained for each 50-cubic yards, or fraction thereof, placed each day for each type of concrete.

1. A "set" of test cylinders consists of four cylinders: one to be tested at 7 days and two

- to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if 28-day test results are low.
2. When the average 28-day compressive strength of the cylinders in any set falls below the specified design strength, proportions, water content, or temperature conditions shall be changed to achieve the required strengths.

C. The testing laboratory shall make slump tests of Class A and Class B concrete as it is discharged from the mixer at the point of placing. Slump tests shall be made for each 25-cubic yards or "pour" of concrete placed. Slump tests may be made on any batch, and failure to meet specified slump requirements shall be sufficient cause for rejection of that batch.

D. Air Content: Test for air content shall be made on fresh concrete samples. Air content for concrete made of ordinary aggregates having low absorption shall be made in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173.

3.05 REMOVAL OF FORMS

A. Removal of Forms

B. Removal of Forms

1. Forms and shoring for elevated structural slabs, girders, and/or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Do not remove supports and re-shore.
2. The following table indicates the minimum allowable time after the last concrete is placed before forms, shoring, and/or bracing may be removed.

Structural Item	Minimum Allowable Time
Bottom side of elevated structural slabs, girders, beams	When concrete reaches specified 28-day compressive strength
Vertical sides of girders, beams	48-hours
Walls not supporting vertical or horizontal loads	48-hours
Walls supporting vertical or horizontal loads	When concrete reaches specified 28-day compressive strength
Slabs on grade and footings	24-hours

3. Do not remove forms from concrete which has been placed with outside air temperature below 50° F without first determining if the concrete has properly set regardless of the minimum times specified in the table above. Do not apply heavy loading on recently poured concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

3.06 FAILURE TO MEET REQUIREMENTS

A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in paragraph 2.02, the Engineer shall have the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.

B. When the tests on control specimens of concrete fall below the specified strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Tests need not be made until concrete has aged 60 days.

C. Should the strength of test cylinders fall below 60 percent of the required minimum 28-day strength, the concrete shall be rejected and shall be removed and replaced.

END OF SECTION

SECTION 04810

UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1) Concrete masonry units
 - 2) Decorative concrete masonry units
 - 3) Mortar and grout
 - 4) Reinforcing steel
 - 5) Masonry joint reinforcement
 - 6) Ties and anchors
 - 7) Embedded flashing
 - 8) Miscellaneous masonry accessories
- B. Related Sections include the following:
 - 1) "Thermal and Moisture Protection" for water repellents applied to unit masonry assemblies.
- C. Products installed, but not furnished, under this Section include the following:
 - 1) Hollow-metal frames in unit masonry openings.

1.03 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strengths (f'_m) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 - 1) For Concrete Unit Masonry: $f'_m = 1500$ psi (10.3 Mpa)

1.05 SUBMITTALS

- A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1) Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
- C. Samples for Verification: For the following:
 - 1) Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 - 2) Accessories embedded in the masonry.

- D. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1) Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents, unless such deviations are specifically brought to the attention of the Architect and approved in writing.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1) Each type of masonry unit required.
 - a. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
 - 2) Mortar complying with property requirements of ASTM C 270.
 - 3) Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.
- G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1) Each type of masonry unit required.
 - a. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
 - 2) Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 - 3) Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 - 4) Each material and grade indicated for reinforcing bars.
 - 5) Each type and size of joint reinforcement.
 - 6) Each type and size of anchor, tie, and metal accessory.
- H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Preconstruction Testing Service: Engage a qualified independent testing agency to perform the following preconstruction testing:
 - 1) Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
 - 2) Mortar Test: For mortar properties per ASTM C 270.
 - 3) Grout Test: For compressive strength per ASTM C 1019.
- E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per

SECTION 04810 UNIT MASONRY ASSEMBLIES

ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

- F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in "Project Meetings."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.08 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1) Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
 - 2) Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1) Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
 - 2) Protect sills, ledges, and projections from mortar droppings.
 - 3) Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4) Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1) Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
 - 1) When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread

SECTION 04810 UNIT MASONRY ASSEMBLIES

mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows:
 - 1) Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
- B. Concrete Masonry Units: ASTM C 90 and as follows:
 - 1) Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 Mpa).
 - 2) Weight Classification: Medium weight.
 - 3) Provide Type II, nonmoisture-controlled units.
 - 4) Size (Width): Manufactured to the following dimensions:
 - a. 8 inches (203 mm) nominal; 7-5/8 inches (194 mm) actual.
 - 5) Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
- C. Decorative Concrete Masonry Units: ASTM C 90 and as follows:
 - 1) Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
 - 2) Weight Classification: Normal weight.
 - 3) Provide Type II, nonmoisture-controlled units.
 - 4) Size: Manufactured to dimensions indicated for nondecorative units.
 - 5) Finish: Exposed faces of the following general description matching color, pattern, and texture of Architect's samples.
 - a. Normal-weight aggregate, split-face finish.
 - 6) Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - i. Block Plus W-10; Addiment Inc.
 - ii Dry-Block; W. R. Grace & Co., Construction Products Division.
 - iii. Rheopel; Master Builders.

2.02 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
- D. Mortar Cement: ASTM C 1329
- E. Masonry Cement: ASTM C 91
- F. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
- G. Aggregate for Grout: ASTM C 404. Retain paragraph below for colored cement or for pigments added at Project site.

SECTION 04810 UNIT MASONRY ASSEMBLIES

- H. Cold-Weather Admixture: Non-chloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
- J. Water: Potable.
- K. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Mortar Cement:
 - a. Magnolia Superbond Mortar Cement; Blue Circle Cement.
 - b. Lafarge Mortar Cement; Lafarge Corporation.
 - 2) Cold-Weather Admixture:
 - a. Accelguard 80; Euclid Chemical Co.
 - b. Morseled; W. R. Grace & Co., Construction Products Division.
 - c. Trimix-NCA; Sonneborn, Div. of ChemRex, Inc.
 - 3) Water-Repellent Admixture:
 - a. Mortar Tite; Addiment Inc.
 - b. Dry-Block Mortar Admixture; W. R. Grace & Co., Construction Products Division.
 - c. Rheopel; Master Builders.

2.03 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60 (Grade 400).

2.04 MASONRY JOINT REINFORCEMENT

- A. General: ASTM A 951 and as follows:
 - 1) Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
 - 2) Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
 - 3) Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
 - 4) Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units where indicated.
- B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches (407 mm) o.c.

2.05 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.
- B. Mill Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 641 (ASTM A 641M), Class 1 coating.
- C. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-coating.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180), commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication.
- E. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.06 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.
- B. Dovetail Slots: Furnish dovetail slots with filler strips, of slot size indicated fabricated from 0.0336-inch (0.85-mm), galvanized steel sheet.

SECTION 04810 UNIT MASONRY ASSEMBLIES

- C. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
 - 1) Headed bolts.
- D. Post-installed Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - 1) Type: Chemical anchors.
 - 2) Type: Expansion anchors.
 - 3) Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
 - 4) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
 - 5) For Post-installed Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
 - 6) For Post-installed Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed.

2.07 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
 - 1) Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.
- C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication.
 - 1) Provide units with either two loops or four loops as needed for number of bars indicated.
- D. Available Products: Subject to compliance with requirements, cavity drainage materials that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Reinforcing Bar Positioners:
 - a. D/A 811; Dur-O-Wal, Inc.
 - b. D/A 816; Dur-O-Wal, Inc.
 - c. No. 376 Rebar Positioner; Heckman Building Products, Inc.
 - d. #RB Rebar Positioner; Hohmann & Barnard, Inc.
 - e. #RB-Twin Rebar Positioner; Hohmann & Barnard, Inc.
 - f. Double O-Ring Rebar Positioner; Masonry Reinforcing Corporation of America.
 - g. O-Ring Rebar Positioner; Masonry Reinforcing Corporation of America.

2.08 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

2.09 MORTAR AND GROUT MIXES

- A. **General:** Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1) Do not use calcium chloride in mortar or grout.
 - 2) Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.
- B. **Pre-blended, Dry Mortar Mix:** Furnish dry mortar ingredients in the form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. **Mortar for Unit Masonry:** Comply with ASTM C 270, Proportion Specification.
- D. **Grout for Unit Masonry:** Comply with ASTM C 476.
 - 1) Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2) Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143.

2.10 SOURCE QUALITY CONTROL

- A. Contractor will engage a qualified independent testing agency to perform source quality-control testing indicated below:
 - 1) Payment for these services will be made by Contractor.
 - 2) Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1) For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - 2) Verify that foundations are within tolerances specified.
 - 3) Verify that reinforcing dowels are properly placed.
 - 4) Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.02 INSTALLATION, GENERAL

- A. **Thickness:** Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut

SECTION 04810 UNIT MASONRY ASSEMBLIES

- with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of textures.
- 1) Mix units from several pallets or cubes as they are placed.

3.03 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.
- E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
- F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
 1. One-half running bond with vertical joint in each course centered on units in courses above and below.
- C. Lay concealed masonry with all units in a wythe in running bond. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
- F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - 1) Install compressible filler in joint between top of partition and underside of structure above.

SECTION 04810 UNIT MASONRY ASSEMBLIES

- 2) Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
- 3) At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with "Thermal and Moisture Protection."

3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 - 1) With full mortar coverage on horizontal and vertical face shells.
 - 2) Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - 3) For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.
- C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.06 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
 - 1) Space reinforcement not more than 16 inches (406 mm) o.c.
 - 2) Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
 - 3) Provide reinforcement not more than 8 inches (203 mm) above and below wall openings
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.07 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

3.08 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
 - 1) Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

SECTION 04810 UNIT MASONRY ASSEMBLIES

- 2) Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
 - 1) Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.09 FIELD QUALITY CONTROL

- A. Contractor will engage a qualified independent testing agency to perform field quality-control testing indicated below.
 - 1) Payment for these services will be made by Contractor.
 - 2) Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
- C. Mortar properties will be tested per ASTM C 780.
- D. Grout will be sampled and tested for compressive strength per ASTM C 1019.
- E. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

3.10 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1) Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2) Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3) Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4) Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
 - 5) Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 6) Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

3.11 MASONRY WASTE DISPOSAL

- A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION

SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.01 SUMMARY

- A. This Section includes structural steel.
- B. This Section includes structural steel and architecturally exposed structural steel.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section "Painting" for surface preparation and priming requirements.

1.03 PERFORMANCE REQUIREMENTS

- A. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.

1.04 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections.
- B. Product Data for each type of product specified.
- C. Shop Drawings detailing fabrication of structural steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
 - 4. Include Shop Drawings signed and sealed by a qualified professional engineer responsible for their preparation.

SECTION 05120 STRUCTURAL STEEL

- D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
 - 1. Structural steel, including chemical and physical properties.
 - 2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 - 3. Shop primers.
 - 4. Nonshrink grout.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
- C. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 - 2. AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
 - 3. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
 - 4. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
 - 5. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
 - 6. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 7. Research Council on Structural Connections' (RCSC) "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

SECTION 05120 STRUCTURAL STEEL

- E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."
 - 1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of "Project Meetings."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.07 SEQUENCING

- A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Steel Shapes, Plates, and Bars: As follows:
 - 1. Carbon Steel: ASTM A 36 (ASTM A 36M).
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Mechanically deposited zinc-coating, ASTM B 695, Class 50.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325.
 - 3. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.
- C. Welding Electrodes: Comply with AWS requirements.

2.02 PRIMER

SECTION 05120 STRUCTURAL STEEL

- A. Primer: SSPC-Paint 25; red iron oxide, zinc oxide, raw linseed oil and alkyd primer.

2.03 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.04 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.
 - 1. Camber structural steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
 - 5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
 - 6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded.
- C. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.
- D. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.
 - 1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
 - 2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.05 SHOP CONNECTIONS

- A. Shop install and tighten high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.

SECTION 05120 STRUCTURAL STEEL

2. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.

B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

2.06 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
- C. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
 1. SSPC-SP 2 "Hand Tool Cleaning."
 2. SSPC-SP 3 "Power Tool Cleaning."
- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.07 SOURCE QUALITY CONTROL

- E. Contractor will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.
 1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
 2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.
- F. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- G. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- H. Shop-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

SECTION 05120 STRUCTURAL STEEL

1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.
- I. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
 1. Liquid Penetrant Inspection: ASTM E 165.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
- B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 - a. Comply with manufacturer's instructions for proprietary grout materials.

SECTION 05120 STRUCTURAL STEEL

- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

- A. Install and tighten high-strength bolts according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 1. Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
 - 2. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.
- B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Assemble and weld build-up sections by methods that will maintain true alignment of axes without warp.
 - 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

3.05 FIELD QUALITY CONTROL

SECTION 05120 STRUCTURAL STEEL

- A. Contractor will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Field-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.
- E. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
 - 1. Liquid Penetrant Inspection: ASTM E 165.

3.06 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in "Painting."

END OF SECTION 05120

SECTION 05120 STRUCTURAL STEEL

SECTION 05500
MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section specifies the labor, materials, equipment, and incidentals required and installation of covers, grates, frames, hatches, manhole rungs, catch basin castings, and other miscellaneous metals as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

- A. The work in this section shall be coordinated with the work of other Sections. Verify at the site both the dimensions and work of other trades that adjoin items of work in this Section before fabrication and installation of items herein specified.
- B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.
- C. Field measurements shall be taken at the site to verify or supplement indicated dimensions and to insure proper fitting of all items.

1.03 SHOP DRAWINGS AND SAMPLES

- A. Submittals shall be submitted to the OWNER for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Submit detail drawings showing sizes of members, method of assembly, anchorage, and connection to other members for all products provided under this section to the OWNER for approval before fabrication.
- C. One (1) product sample of each type of product shall be submitted to the OWNER upon request. Samples shall be submitted for concurrent review with Shop Drawings.

1.04 REFERENCE STANDARDS

A. Unless otherwise specified, materials shall conform to the following:

Structural Steel	ASTM A36
Welded and Seamless Steel Pipe	ASTM A53
Gray Iron Castings	ASTM A48, Class 30
Galvanizing, general	ASTM A123
Galvanizing, hardware	ASTM A153
Galvanizing, assemblies	ASTM A386
Aluminum (Extruded Shapes)	
6061 T6 (Alum. alloy)	
Aluminum (Extruded Pipe)	6063 T6 (Alum. alloy)
Aluminum Bar Structural	6061 T6 (Alum. alloy)
Bolts and Nuts	
ASTM, A307	
Stainless Steel Bolts, Fasteners	AISI, Type 316
Stainless Steel Plate and Sheet, Wire	AISI, Type 316
Welding Rods for Steel	AWS Spec. for Arc Welding

PART 2 - PRODUCTS

2.01 ANCHORS, BOLTS, AND FASTENING DEVICES

- A. Anchors, bolts, and other fastening devices shall be furnished as necessary for installation of the work of this Section.
- B. Compound masonry anchors shall be of the type shown or required and shall be Star Slug compounded masonry anchors manufactured by Star Expansion Industries, by Phillips Drill Co., Rahplug, or acceptable equal. Anchors shall be minimum "2-unit" type.
- C. The bolts used to attach the various members to the anchors shall be the sizes shown or required. Stainless steel shall be attached to concrete or masonry by means of stainless steel machine bolts and iron or steel shall be attached with steel machine bolts unless otherwise specifically noted.
- D. For structural purposes, unless otherwise noted, expansion bolts shall be Wej it "Ankr Tite", Phillips Drill Co. "Wedge Anchors", Hilti "Kwik Bolt", or acceptable equal. When length of bolt is not called for on the Drawings, the length of bolt provided shall be sufficient to place the wedge portion of the bolt a minimum of 1-inch behind the reinforcing steel within the concrete.
- E. Materials for anchor or expansion bolts shall be as noted on the Drawings. If no specific material is listed, hot dipped galvanized steel shall be used. All hardware inside wetwells, manholes, or other wetted areas shall be 316 Stainless Steel.

2.02 ALUMINUM ITEMS

- A. Prefabricated checker plate aluminum hatches shall be Type "JD", or "KD" as manufactured by Bilco Co., equal type by Babcock Davis Associates, Inc.; or acceptable equal, sized as shown. Hatches with any single dimension over 3-feet 6-inches shall be double leaf type. Hatches shall be designed for a live load of 300-pounds per square foot. Hatches shall be watertight.
- B. Check plate aluminum cover plates shall be fabricated to the details shown and installed at the locations shown.
- C. Miscellaneous aluminum shapes and plates shall be fabricated as shown. Angle frames for hatches, beams, grates, etc., shall be furnished complete with welded strap anchors attached. Furnish all miscellaneous aluminum shown but not otherwise detailed. Structural shapes and extruded items shall conform to the detail dimensions or the plans within the tolerances published by the American Aluminum Association.

2.03 STEEL ITEMS

- A. Sleeves shall be steel or cast iron pipe in walls and floors with end joints as shown on the Drawings. All pipe sleeves shall have anchors centered on the circumference as shown.
- B. Miscellaneous steel pipe for sleeves, lifting attachments, and other uses as required shall be Schedule 40 pipe fabricated according to the details as shown on the Drawings.

2.04 CAST IRON ITEMS

- A. Outside pipe clean out frames and covers shall be heavy duty, R 6013 R 6099 series as manufactured by Neenah Foundry Co., or acceptable equal. All outside pipe cleanouts shall be 6-inch diameter.
- B. Trench drain shall be of length shown on the Drawings and shall be heavy duty, cast iron, open grate lid type, Series R 4990 Type A as manufactured by Neenah Foundry Co., or acceptable equal.

- C. Gray iron castings for manhole frames, covers, adjustment rings, and other items shall conform to ASTM A48, Class 30B. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects which would impair their strength or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the Drawings. All manhole frames and covers shall be traffic bearing to meet AASHTO H 20 loadings. Frames shall be suitable for the future addition of a cast iron ring for upward adjustment of top elevation.

PART 3 - EXECUTION

3.01 FABRICATION

- A. All miscellaneous metalwork shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.
- B. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by the fitting.
- C. Welded joints shall be rigid and continuously welded or spot-welded as specified or shown. The face of welds shall be dressed flush and smooth. Exposed joints shall be close fitting and jointed where least conspicuous.
- D. Welding of parts shall be in accordance with the Standard Code for Arc and Gas Welding in Building Construction of the AWS and shall only be done where shown, specified, or permitted by the OWNER. All welding shall be done only by welders certified as to their ability to perform welding in accordance with the requirements of the AWS code. Component parts of built up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.
- E. Welding of aluminum work shall be on the unexposed side as much as possible in order to prevent pitting or discoloration.
- F. All aluminum finish exposed surfaces, except as specified below, shall have manufacturers' standard mill finish. Aluminum handrails shall be given an anodic oxide treatment in accordance with the Aluminum Association Specification AA C22 A41. A coating of methacrylate lacquer shall be applied to all aluminum before shipment from the factory.

- G. Castings shall be of good quality, strong, tough, even grained, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field by the OWNER. All finished surfaces shown on the Drawings and/or specified shall be machined to a true plane surface and shall be true and seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified or shown shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95% (percent) of the theoretical weight computed from the dimensions shown. The Contractor shall provide facilities for weighing castings in the presence of the OWNER showing true weights, certified by the supplier.
- H. All steel finish work shall be thoroughly cleaned of all loose mill scale, rust, and foreign matter before shipment and shall be given 1 shop coat of primer in accordance with Section 09865 "Surface Preparation and Shop Prime Painting." Abrasions in the field shall be touched up with primer immediately after erection. Final painting shall be in accordance with Section 09900 "Painting."
- I. Galvanizing shall be the hot dip zinc process after fabrication. Following all manufacturing operations, all items to be galvanized shall be thoroughly cleaned, pickled, fluxed, and completely immersed in a bath of molten zinc. The resulting coating shall be adherent and shall be the normal coating to be obtained by immersing the items in a bath of molten zinc and allowing them to remain in the batch until their temperature becomes the same as the bath. Coating shall be not less than 2-ounces per square foot of surface.

3.02 INSTALLATION

- A. Install all items furnished except items to be imbedded in concrete or masonry, which shall be installed under Division 3 or Division 4 respectively. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted. All dimensions shall be verified at the site before fabrication is started.
- B. All steel surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.
- C. Where aluminum is embedded in concrete, apply a heavy coat of approved bitumastic troweling mastic in accordance with the manufacturer's instructions prior to installation.
- D. Where aluminum contacts masonry or concrete, provide a 1/32-inch neoprene gasket between the aluminum and the concrete or masonry.
- E. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc chromate primer and provide a 1/32-inch neoprene gasket between the aluminum and the dissimilar metal.

- F. Where aluminum contacts wood, apply 2 coats of aluminum metal and masonry paint to the wood.

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Wood furring, grounds, nailers, and blocking.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. SECTION 09250 - GYPSUM DRYWALL
 - 2. SECTION 09900 - PAINTING for field-applied paint finish.

1.03 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

1.04 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections.
 - 1. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee (ALSC) Board of Review.
 - 2. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
 - a. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - b. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.

SECTION 06100 ROUGH CARPENTRY

3. Warranty of chemical treatment manufacturer for each type of treatment.

1.05 QUALITY ASSURANCE

- A. Single-Source Responsibility for Products: Obtain each type of product from one (1) source and by a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other materials. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wood-Preservative-Treated Materials:

- a. CHEMICAL SPECIALTIES, INC.
- b. HICKSON CORPORATION.
- c. OSMOSE WOOD PRESERVING, INC.

2.02 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, American Softwood Lumber Standard, and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

1. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - a. SPIB - Southern Pine Inspection Bureau.
 - b. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
 - c. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency.
 - d. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - e. Provide dressed lumber, S4S, unless otherwise indicated.

SECTION 06100 ROUGH CARPENTRY

2.03 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
- B. Do not use chemicals containing chromium or arsenic.
- C. For exposed items indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
 - 1. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb./cu. ft. After treatment, kiln-dry lumber to a maximum moisture content of 19%, respectively. Treat indicated items and the following:
 - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - c. Wood members less than 18" above-grade.
 - d. Wood floor plates installed over concrete slabs directly in contact with earth.
 - 2. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.04 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, gypsum drywall nailers/backing boards and similar members.
 - 1. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
 - 2. Moisture Content: 19% maximum for lumber items not specified to receive wood preservative treatment.
 - 3. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 2 grade per SPIB.

SECTION 06100 ROUGH CARPENTRY

2.05 STRUCTURAL-USE PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32" thick.

2.06 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153.
 - 1. Nails, Wire, Brads, and Staples: FS FF-N-105.
 - 2. Power-Driven Fasteners: CABO NER-272.
 - 3. Wood Screws: ASME B18.6.1.
 - 4. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)
 - 5. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
 - 1. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
 - 2. Apply field treatment complying with AWWA M4 to cut surfaces of preservative-treated lumber and plywood.
 - 3. Securely attach Rough Carpentry Work to substrate by anchoring and fastening as indicated, complying with the following:
 - a. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.
 - b. Published requirements of metal framing anchor manufacturer.
 - c. Table 1705.1--Fastening Schedule, of the Standard Building Code.
 - 4. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make

SECTION 06100 ROUGH CARPENTRY

tight connections between members. Install fasteners without splitting wood; pre-drill as required.

5. Use hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.

3.02 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

END OF SECTION

SECTION 06176

METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes wood roof and girder trusses and truss accessories.
- B. Related Sections include the following:
 - 1. Section "Rough Carpentry" for roof sheathing and dimension lumber for supplementary framing and permanent bracing.

1.03 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.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. SPIB – Southern Pine Inspection Bureau

1.04 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads:
Minimum Loads:
TCLL=20 psf
TCDL=20 psf
BCDL=10 psf
And/or as indicated on the drawings.
 - 2. Maximum Deflection Under Design Loads:
 - a. Roof Trusses: Vertical deflection of 1/240 of span.

1.05 SUBMITTALS

SECTION 06176 METAL-PLATE-CONNECTED WOOD TRUSSES

- A. Product Data: For metal-plate connectors, metal framing anchors, bolts, and fasteners.
- B. Shop Drawings: Show location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber; splice details; type, size, material, finish, design values, orientation, and location of metal connector plates; and bearing details.
 - 1. or installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.
- D. Qualification Data: For metal-plate manufacturer.
- E. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.
- F. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - 1. Metal-plate connectors
 - 2. Metal framing anchors.

1.06 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with TPI quality-control procedures for manufacture of connector plates published in TPI 1.
 - 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. Source Limitations for Connector Plates: Obtain metal connector plates through one source from a single manufacturer.
- C. Comply with applicable requirements and recommendations of the following publications:
 - 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."

SECTION 06176 METAL-PLATE-CONNECTED WOOD TRUSSES

2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- D. Wood Structural Design Standard: Comply with applicable requirements in AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with TPI recommendations to avoid damage and lateral bending. 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.

1.08 COORDINATION

- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Metal Connector Plates:
 - a. Alpine Engineered Products, Inc.
 - b. Mitek Industries, Inc.
 2. Metal Framing Anchors:
 - a. Alpine Engineered Products, Inc.
 - b. Simpson Strong-Tie Company, Inc.
 - c. Southeastern Metals Manufacturing Co., Inc.

2.02 DIMENSION LUMBER

SECTION 06176 METAL-PLATE-CONNECTED WOOD TRUSSES

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified.
 - 3. Provide dry lumber with 15 percent maximum moisture content at time of dressing.
- B. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

2.03 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates to comply with TPI 1 from metal complying with requirements indicated below:
- B. Hot-Dip Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180) coating designation; Designation SS, Grade 33, and not less than 0.036 inch (0.9 mm) thick.

2.04 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load

SECTION 06176 METAL-PLATE-CONNECTED WOOD TRUSSES

imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.05 METAL FRAMING ANCHORS

- A. General: Provide framing anchors made from metal indicated, of structural capacity, type, and size indicated, and as follows:
 1. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
 2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall 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 A 653/A 653M, G60 (Z180) coating designation.
- C. Truss Tie-Downs (Hurricane Ties): As scheduled on the drawings.

2.06 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- B. Protective Coatings: SSPC-Paint 22, epoxy-polyamide primer.

2.07 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.

SECTION 06176 METAL-PLATE-CONNECTED WOOD TRUSSES

- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. Before installing, splice trusses delivered to Project site in more than one piece.
- 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 24 inches (610 mm) o.c. as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor 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.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not cut or remove truss members.
- L. Replace wood trusses that are damaged or do not meet requirements.
 - 1. Do not alter trusses in field.
- M. Install bridging and blocking between trusses as indicated on the drawings.

3.02 REPAIRS AND PROTECTION

SECTION 06176 METAL-PLATE-CONNECTED WOOD TRUSSES

- A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
 - 1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION

SECTION 07411 METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roll-formed metal roof panels and related flashing/trim, sealant, and other accessories to provide complete roofing system.

1.2 RELATED REQUIREMENTS

- A. Division 7 Section "Sheet Metal Flashing and Trim" for flashing items not covered in this section.

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced.
- B. American Society of Civil Engineers (ASCE)
 - 1. ASCE 7 Minimum Design Loads for Buildings and Other Structures
- C. ASTM International (ASTM)
 - 1. ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
 - 2. ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
 - 3. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 4. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 5. ASTM C920 Standard Specification for Elastomeric Joint Sealants
 - 6. ASTM D1308 Effect of Household Chemicals on Clear and Pigmented Organic Finishes
 - 7. ASTM D1970/D1970M Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
 - 8. ASTM D2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
 - 9. ASTM D2247 Testing Water Resistance of Coatings in 100% Relative Humidity
 - 10. ASTM D2794 Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
 - 11. ASTM D3359 Standard Test Methods for Rating Adhesion by Tape Test
 - 12. ASTM D3363 Film Hardness by Pencil Test
 - 13. ASTM D4214 Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
 - 14. ASTM D4587 Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
 - 15. ASTM D522/D522M Mandrel Bend Test of Attached Organic Coatings
 - 16. ASTM D523 Standard Test Method for Specular Gloss
 - 17. ASTM D610 Evaluating Degree of Rusting on Painted Steel Surfaces
 - 18. ASTM D822 Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
 - 19. ASTM D968 Abrasion Resistance of Organic Coatings by Falling Abrasive
 - 20. ASTM E1592 Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
 - 21. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - 22. ASTM G152 Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
 - 23. ASTM G153 Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
- B. Metal Building Manufacturers Association (MBMA):

- 1.MBMA RSDM Metal Roofing Systems Design Manual
 - C. National Roofing Contractors Association (NRCA)
 - 1.NRCA 0420 Architectural Metal Flashing, Condensation Control and Reroofing
 - 2.The NRCA Roofing Manual
 - D. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 - 1.SMACNA Architectural Sheet Metal Manual
 - E. Underwriter's Laboratory (UL)
 - 1.UL 580 Tests for Uplift Resistance of Roof Assemblies
- 1.4 SUBMITTALS
- A. Shop Drawings
 - 1.Roofing Panels
 - 2.Flashings and Accessories
 - 3.Gutter/Downspout Assembly
 - B. Product Data: Submit manufacturer's catalog data for the following items:
 - 1.Roof Panels
 - 2.Factory-Applied Color Finish
 - 3.Accessories
 - 4.Fasteners
 - 5.Underlayment
 - 6.Gaskets and Sealing/Insulating Compounds
 - C. Samples
 - 1.Roof Panels
 - D. Manufacturer's Instructions
 - 1.Installation Manual
 - E. Closeout Submittals
 - 1.Warranties
- 1.5 QUALITY ASSURANCE
- A. Qualification of Manufacturer: Submit documentation verifying metal roof panel manufacturer has been in the business of manufacturing metal roof panels for a period of not less than 25 years.
 - B. Manufacturer's Quality Assurance Program: Submit documentation verifying metal roof panel manufacturer manages an internal quality assurance program designed to produce and deliver product in full and on time, in 95% of deliveries over a 12-month average.
 - C. Single Source: Roofing panels, fasteners, clips, closures, and other accessories must be standard products supplied by the manufacturer, and the most recent design of the manufacturer to operate as a complete system for the intended use.
 - D. Qualification of Installer: Metal roof system installer must be licensed in the state or municipality where the project will take place, and shall be factory trained by the manufacturer. Installer shall have a minimum of three years' experience installing the specified roof system. Supply the names, locations and client contact information of 5 projects of similar size and scope constructed by applicator using the manufacturer's roofing products submitted for this project within the previous three years.
 - E. All trim shall be manufactured in a facility owned and operated by the manufacturer of the roofing system.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, and handle panel materials, bulk roofing products, accessories, and other manufactured items in a manner to prevent damage and deformation, as recommended by the manufacturer, and as specified.
 - B. Delivery: Package and deliver materials to the site in undamaged condition. Provide adequate packaging to protect materials during shipment. Do not uncrate materials until ready for use, except for inspection. Immediately upon arrival of materials at jobsite, inspect materials for damage, deformation, dampness, and staining. Remove affected

materials from the site and immediately replace. Remove moisture from wet materials not otherwise affected, restack and protect from further moisture exposure.

- C. Handling: Handle materials in a manner to avoid damage. Select and operate material handling equipment so as not to damage materials or applied roofing.
- D. Storage: Stack materials stored on site on platforms or pallets, and cover with tarpaulins or other weathertight covering which prevents trapping of water or condensation under the covering. Store roof panels so that water which may have accumulated during transit or storage will drain off. Do not store panels in contact with materials that might cause staining. Secure coverings and stored items to protect from wind displacement.
- E. Manufacturer must have a manufacturing facility within 400 miles of job location.
- F. All roofing materials shall be delivered on trucks owned and operated by the manufacturer of the roof system.

1.7 WARRANTY

- A. Furnish the metal roof panel manufacturer's warranty as described below and subject to the applicable terms, conditions, and exclusions:

1.[Steel Substrate: Warrant that steel substrate will not as a result of corrosion rupture, fail structurally, or perforate for a period of 25 years.]

1.8 CONFORMANCE AND COMPATIBILITY

- A. The entire metal roofing and flashing system must be in accordance with specified and indicated requirements, including wind requirements. Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the MBMA RSDM, NRCA, the metal panel manufacturer's published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the project manager for approval prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: Gulf Coast Supply and Manufacturing, LLC; Newberry, FL.
Tel: 888-393-0335 | Email: info@gulfcoastsupply.com | Web: www.gulfcoastsupply.com

1.[24ga steel] 5V Crimp with 7/16" tall seam. [flat]. 24" coverage.

2.2 PERFORMANCE REQUIREMENTS

- A. Material:
 - 1.Steel panels and accessory components must conform to the following standard(s): ASTM A792 and ASTM A924
 - 2.Aluminum panels and accessory components must conform to the following standard(s): ASTM B209
- B. Wind Uplift
 - 1. Florida Product Approval : FL#33818.1
- C. Impact Resistance
 - 1.Provide UL Class 4 metal roof panel system tested according to UL 2218.
- D. Fire Testing
 - 1.Provide a Class A metal roof panel system tested according to UL 790.

2.3 METAL ROOF PANEL ACCESSORIES

Accessories must be compatible with the metal roof panels. Sheet metal flashing, trim, metal closure strips, caps, and similar metal accessories must be not less than the minimum thicknesses specified for roof panels. Provide exposed metal accessories to match the panels furnished [except as otherwise indicated]. Molded foam rib, ridge and other closure strips must be closed-cell or solid-cell synthetic rubber or neoprene pre-molded to match configuration of the panels and not absorb or retain water. Pre-manufactured accessories must be manufacturer's standard for intended purpose, compatible with the metal roof system and approved for use by the metal roof panel manufacturer. Support all rooftop equipment/penetrations with curbs designed to structurally support the intended use. Construct curbs to match roof slope.

- A. Fasteners:

- 1.Exposed Fasteners: Fasteners for roof panels must be corrosion resistant **[coated steel]**, compatible with the sheet panel or flashing material and of the type and size recommended by the manufacturer to meet the performance requirements and design loads. Fasteners for accessories must be the manufacturer's standard. Provide an integral metal washer, matching the color of attached material with compressible sealing EPDM gasket.
- 2.Screws: Provide corrosion resistant screws, **[coated steel]** of the type and size recommended by the manufacturer to meet the performance requirements.
- 3.Rivets: Provide blind rivets, corrosion resistant **[coated steel]** and color matched. Seat rivets in polyether sealant where watertight connections are required.

B. Sealants: Basis of Design Titebond WeatherMaster Metal Roof Sealant

- 1.Sealants shall be a polyether containing a minimum solid content of 99 percent of the total volume.
- 2.Shall be tested in accordance with ASTM C920 Type S, Grade NS, Class 50, Use NT, T, G, A and O.
- 3.Sealant shall have an additive within it that allows it to stick to PVDF coated metal without applying a primer.
- 4.Field Applied Sealants: Color to match panel color.
- 5.Tape Sealants: Provide pressure sensitive, 100 percent solid tape sealant with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the roof panel manufacturer.

C. Sheet Metal Flashing and Trim: All flashing shall be manufactured by the roof system manufacturer. Obtain and verify field measurements for accurate fit prior to shop fabrication. Fabricate flashing and trim without excessive oil canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

D. Underlayment: Provide self-adhering modified underlayment material in compliance with ASTM D1970/D1970M, suitable for use as underlayment for metal roofing, 60 mils thick. Use membrane resistant to cyclical elevated temperatures for extended period of time in high heat service conditions. Provide membrane with integral non-tacking top surface of polyethylene film or other surface material to serve as separator between bituminous material and metal products to be applied above.

E. Gaskets: Gaskets and sealing/insulating compounds must be nonabsorptive and suitable for insulating contact points of incompatible materials. Sealing/insulating compounds must be non-running after drying.

F. Finish Repair Materials: Repair paint for color finish enameled roofing must be compatible paint of the same formula and color as the specified finish furnished by the manufacturer. Only use repair and touch-up paint supplied by the roof panel manufacturer and is compatible with the specified system.

2.4 FABRICATION

- A. Fabricate and finish metal roof panels and accessories on a factory stationary roll former to the greatest extent possible, per manufacturer's standard procedures and processes, and as necessary to fulfill indicated performance requirements. Comply with indicated profiles, dimensional and structural requirements.

2.5 FINISHES

- A. Galvalume – 24 gauge
- B. Finish quality and application processes must conform to the related standards specified within this section. Noticeable variations within the 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 any contrasting variations.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the work. Ensure surfaces are suitable, dry and free of defects and projections which might affect the installation.
- B. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural support members for panels and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer, UL, ASTM, and ASCE 7.
- C. 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, or total variation less than $\pm 1/2"$ from line of true slope in 10'.
- D. Examine rough-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of panels prior to installation.
- E. Submit a written report to the project manager listing conditions detrimental to the performance of the work. Proceed with installation only after defects have been corrected or the impacts identified have been accepted in writing.

3.2 METAL PANEL INSTALLATION

- A. Installation must meet specified requirements and be in accordance with the manufacturer's installation instructions and approved shop drawings. Do not install damaged materials. Dissimilar materials which are not compatible when contacting each other must be insulated by means of gaskets or sealing/insulating compounds. Keep all exposed surfaces and edges clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Remove stained, discolored, or damaged materials from the site.
- B. Preparation:
 - 1. Clean all substrate substances which may be harmful to roof panels including removing projections capable of interfering with roof panel attachment.
 - 2. Install sub-purlins, eave angles, furring, decking, and other miscellaneous roof panel support members and anchorage according to manufacturer's written instructions, the project design, and applicable codes.
- C. Underlayment:
 - 1. Install underlayment according to the underlayment manufacturer's written recommendations, the roof panel manufacturer's written recommendations and recommendation in NRCA "The NRCA Roofing and Waterproofing Manual".
 - 2. Show the extent and location of the appropriate underlayment on the drawings. The underlayment must ensure that any water penetrating below the roof panels will drain outside of the building envelope.
 - 3. Install self-adhering sheet underlayment; wrinkle free on roof deck. Comply with temperature installation restrictions of manufacturer where applicable. Install at locations indicated on project drawings, lapped in a direction to shed water. Lap sides not less than 4 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Cover underlayment within 30 days
- D. Metal Panel Installation
 - 1. Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels or other components of the Work securely in place, with provisions for thermal and structural movement in accordance with NRCA 0420. Use approved fasteners and clips as required by section 2.3.
 - 2. Metal Protection: Where dissimilar metals contact each other or possibly corrosive substrates, protect against galvanic action by applying rubberized asphalt underlayment to each contact surface.
 - 3. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and required for weatherproof performance of metal roof panel system. Provide types

of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

4. Handling and Erection

- i. Erect roofing system in accordance with the approved erection drawings, printed instructions and safety precautions of the manufacturer.
- ii. Do not subject panels to overloading, abuse, or undue impact. Do not apply bent, chipped, or defective panels. Damaged panels must be replaced and removed from the site at the contractor's expense. Erect panels true, plumb, and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with indicated rake, eave, and curb overhang. Allow for thermal movement of the roofing, movement of the building structure, and provide permanent freedom from noise due to wind pressure.
- iii. Do not permit storage, walking, wheeling or trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to the installed roofing materials, and to distribute weight to conform to the indicated live load limits of the roof construction.
- iv. Roof panels must be laid with corrugations in the direction of the roof slope. End laps of exterior roofing must not be less than 12 inches; side laps of standard exterior corrugated panels must not be less than 2-1/2 corrugations (or one rib for Gulf Rib or GulfPBR panels)
- v. Field cutting of metal roof panels by torch or abrasive blades is not permitted. Field cut only as recommended by manufacturer's written instructions.

5. Closure Strips

- i. Install closure strips at open ends of metal ridge rolls; open ends of corrugated or ribbed pattern roofs, and at intersection of wall and roof, unless open ends are concealed with formed eave flashing; rake of metal roof unless open end has a formed flashing member; and in other required areas.
- ii. Install closure strips at intersection of the wall with metal roofing; top and bottom of metal siding; heads of wall openings; and in other required locations.

6. Workmanship

- i. Make lines, arises, and angles sharp and true. Free exposed surfaces from any visible wave, warp, buckle and tool marks. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.
- ii. Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and as necessary to make the work watertight.

3.3 ACCESSORY INSTALLATION

- A. Fastener Installation: Anchor metal roof panels and other components of the Work securely in place, using approved fasteners according to manufacturer's written instructions.
- B. Flashing, Trim, and Closure Installation
 1. Comply with performance requirements, manufacturer's written installation instructions, and SMACNA. Provide concealed fasteners where possible. Set units true to line and level as indicated. Install work with laps, joints, and seams

that will be permanently water tight and weather resistant. Work is to be accomplished to form weather tight construction without waves, warps, buckles, fastening stresses or distortion, and to allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accomplish the work must conform to the manufacturers written instructions.

2. Install exposed metal flashing at building corners, rakes, eaves, junctions between metal siding and roofing, valleys and changes off slope or direction in metal roofing, building expansion joints and gutters.
3. Exposed metal flashing must be the same material, color, and finish as the specified metal roofing panels. Lap ends of flashing minimum of 4" and seal with approved joint sealant. Box out ends of flashing where required and provide rivets at corners and as required to create a stable and weathertight system.
4. Fasten flashing at not more than 12 inches on center for roofs, except where flashing is held in place by the same screws used to secure panels. Exposed flashing and flashing subject to rain penetration must be bedded in specified joint sealant. Flashing which is contact with dissimilar metals must be isolated by means of the specified asphalt mastic material to prevent electrolytic deterioration.

3.4 FIELD QUALITY CONTROL

A. ACCEPTANCE PROVISIONS

1. Erection Tolerances: Erect metal roofing straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions. Variation in coverage ("stretching" or "compressing" the panel width) not to exceed $\pm 1/16$ " per panel and accumulated variation not to exceed $\pm 1/500$ (2.4" in 100'). Total combined deviation from true due to fanning/dogleg shall not exceed panel length divided by 500 ($\pm L/500$).

B. Leakage Tests

1. Finished application of metal roofing is to be subject to inspection and test for leakage by the Project Manager or designated representative, and Architect/Engineer.
2. Inspection and testing is to be made promptly after erection to permit correction of defects and removal/replacement of defective materials.

C. Repairs to Finish

1. Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials and as recommended by the metal roof panel manufacturer. Repaired metal surfaces that are not acceptable to the project requirements are to be immediately removed and replaced with new material.

3.5 CLEANING AND PROTECTION

- A. Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating. Touch up scratches in panel finish with manufacturer supplied touch-up paint system to match panel finish.
[Treat exposed cut edges with manufacturer supplied [clear coat.]
- B. Collect all scrap/waste materials and place in containers. Promptly dispose of demolished and scrap materials.
- C. Do not permit storing, walking, wheeling, and trucking directly on applied roofing/insulation materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing/insulation materials, and to distribute weight to conform to indicated live load limits of roof construction.

SECTION 07620

SHEETMETAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes sheetmetal flashing and trim in the following categories:
 - 1. Exposed trim, gravel stops, and fascia.
 - 2. Metal flashing.
 - 3. Self-adhering, self-sealing flashing.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Sections for through-wall flashing and other integral masonry flashings specified as part of masonry work.
 - 2. SECTION 07901 - JOINT SEALANTS for elastomeric sealants.

1.03 PERFORMANCE REQUIREMENTS

- A. General: Install sheetmetal flashing and trim to withstand wind loads, structural movement, thermally- induced movement, and exposure to weather without failing.

1.04 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections.
 - 1. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
 - 2. Samples of sheetmetal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of two (2) or more units showing the full range of variations expected.
 - 3. 12"-long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.
 - 4. Provide full range of manufacturer's colors and finishes.

SECTION 07620 SHEETMETAL FLASHING AND TRIM

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experience Installer who has completed sheetmetal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.06 PROJECT CONDITIONS

- A. Coordinate Work of this Section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.01 METALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), 3003-H14, mill finish, minimum thickness of 0.040".
- B. All exposed flashing and fascia to be pre-finished.

2.02 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Fasteners: Same metal as sheetmetal flashing or other non-corrosive metal as recommended by sheetmetal manufacturer. Match finish of exposed heads with material being fastened.
- B. Elastomeric Sealant: Generic type recommended by sheetmetal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in SECTION 07901 - JOINT SEALANTS.
- C. Polyethylene Underlayment: ASTM D 4397, minimum 6-mil-thick black polyethylene film, resistant to decay when tested according to ASTM E 154.
- D. Metal Accessories: Provide sheetmetal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; non-corrosive; size and thickness required for performance.

2.03 FABRICATION, GENERAL

- A. Sheetmetal Fabrication Standard: Fabricate sheetmetal flashing and trim to comply with recommendations of SMACNA's Architectural Sheetmetal Manual that apply to the design, dimensions, metal, and other characteristics of the item indicated.
 - 1. Comply with details shown to fabricate sheetmetal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once

SECTION 07620 SHEETMETAL FLASHING AND TRIM

- installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheetmetal.
2. Form exposed sheetmetal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
 3. Seams: Fabricate overlapping non-moving seams in sheetmetal.
 - a. Expansion Provisions: Space movement joints at maximum of 10' with no joints allowed within 24" of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant (concealed within joints).
 4. Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheetmetal exposed to public view.
 6. Fabricate cleats and attachment devices from same material as sheetmetal component being anchored or from compatible, non-corrosive metal recommended by sheetmetal manufacturer.
 7. Size: As recommended by SMACNA manual or sheetmetal manufacturer for application but never less than thickness of metal being secured.

2.04 SHEETMETAL FABRICATIONS

- A. General: Fabricate sheetmetal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
1. Exposed Trim and Fasciae: Fabricate from the following material:
 - a. Aluminum: 0.040".
 2. Base Flashing: Fabricate from the following material:
 - a. Aluminum: 0.040".
 3. Counterflashing: Fabricate from the following material:
 - a. Aluminum: 0.040".
 4. Flashing Receivers: Fabricate from the following material:
 - a. Aluminum: 0.040".
 5. Drip Edges: Fabricate from the following material:
 - a. Aluminum: 0.040".
 6. Eave Flashing: Fabricate from the following material:
 - a. Aluminum: 0.040".
 7. Equipment Support Flashing: Fabricate from the following material:
 - a. Aluminum: 0.040".
 8. Roof-Penetration Flashing: Fabricate from the following material:
 - a. Aluminum: 0.040".

SECTION 07620 SHEETMETAL FLASHING AND TRIM

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which sheetmetal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Unless otherwise indicated, install sheetmetal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's Architectural Sheetmetal Manual. Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weather-proof.
- B. Install exposed sheetmetal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheetmetal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheetmetal.
 - 1. Expansion Provisions: Provide for thermal expansion of exposed sheetmetal Work. Space movement joints at maximum of 10' with no joints allowed within 24" of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1" deep, filled with mastic sealant (concealed within joints).
 - 2. Sealed Joints: Form non-expansion, but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
 - 3. Use joint adhesive for non-moving joints.
- C. Separations: Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
- D. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.
- E. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.

SECTION 07620 SHEETMETAL FLASHING AND TRIM

- F. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2" and bed with sealant.
- G. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Weld or seal flashing to equipment support member.
- H. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:
 - 1. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

3.03 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Provide final protection and maintain conditions that ensure sheetmetal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION

SECTION 07621 GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Gutters and downspouts
- B. Accessories

1.2 SUBMITTALS

- A. Refer to Section 01300
- B. Product Data: Submit manufacturer current technical literature for each type of product.
- C. Samples: Provide nominal 3 x 5 inch sample of each color up to three color selections for gutters, downspouts and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. It is the contractor's responsibility to verify gutter and downspouts are sized in accordance with local building codes for rainfall intensities based on project specific roof areas.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall have a minimum of five (5) years experience in the production of sheet metal gutters and downspouts.
- B. Fabricator Qualifications: Shall be approved by manufacturer for fabrication of gutters and downspouts.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 1610
- B. Store materials on dry, level, firm, and clean surface.

1.6 WARRANTY

A. Finish Warranty:

1. Manufacturing Defects: Standard form in which manufacturer agrees to repair or replace items that fail by blistering, checks, crazes, flakes, peels or weathers unevenly due to a defect in manufacturing within warranty period from date of original installation.
2. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 GUTTERS

A. Materials:

1. Aluminum Coil Stock: Formed and coated aluminum coil stock; 3105 H24 aluminum.

B. K-Style Gutter Fabrication:

1. Gutter Size: 5" or as indicated on Drawings.
2. Length: Continuous.
3. Aluminum Thickness: 0.040 inch.

C. Gutter Corner Fabrication:

1. Provide mitered corners, welded and sealed Corners shall extend a minimum of 12 inches from the corner in each direction. Lap joint and sealant where connecting to continuous gutter.
2. Match material, shape and finish of gutter.

2.2 DOWNSPOUTS

A. Rectangular downspout fabrication:

1. Size: 3 by 4 inches or as indicated on Drawings.
2. Length: Custom length.
3. Texture: Corrugated.
4. Aluminum Thickness: 0.040 inch

2.3 ACCESSORIES

A. Gutters:

1. End Caps: Match material, shape and finish of gutter.
2. Outlet Tubes: Match material and shape of downspout.

3. Gutter Support:

- a. Hidden Gutter Hanger: Manufacturer's standard aluminum hidden hanger.

B. Downspouts:

1. Downspout Support:

- a. Exposed strap.
- b. Color: As selected from manufacturer's full color line.

- 2. Miscellaneous downspout components: Provide all necessary elbows, downspout offset sections, and pop rivets as required for a complete installation. All miscellaneous components shall match downspouts.

C. Fasteners:

- 1. Stainless steel fasteners of sufficient length to penetrate minimum 1 inch into substrate.

D. Flashing: Provide flashing complying with Section 07620 Sheet Metal Flashing and Trim at roof apron, fascia apron, and where indicated.

E. Sealants: Tripolymer, single component sealant as recommended by manufacturer at gutter joints.

F. Downspout Strainer: Aluminum wire-ball downspout strainer.

G. Splash Pans: Fabricate from the following. Size and shape as indicated on Drawings.

- 1. Pre-cast Concrete: Profile as selected by Engineer. Concrete shall be 3,000 psi at 28 days with minimum of 5 percent air entrainment.

2.4 FINISH

A. Exterior Coating:

- 1. Standard Coating; Kynar 500 or Hylar 5000 applied to exposed side. Color as selected by Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are in place and ready for installation of gutters and downspouts.

3.2 INSTALLATION

- A. General: Install Work securely in place and provide for expansion and contraction of components using lapped and sealed joints
 - 1. Do not install damaged components.
 - 2. Separate dissimilar metals to prevent galvanic action through the use of bituminous coating or other permanent separation recommended by SMACNA.
 - 3. Space expansion joints in gutters as recommended by manufacturer.
 - 4. Rivet joints where required for strength, exposed rivet shall match gutter or downspout color.
 - 5. Torch cutting of components is not allowed.
- B. Install roof edge flashings at roof edge conditions as indicated on Drawings.
- C. Gutters:
 - 1. Install gutter supports at no more than 24 inches on center.
 - 2. Slope gutters evenly to downspouts; provide end caps at gutter ends and seal watertight per manufacturer's instructions.
 - 3. Install outlet tubes at all downspout locations, seal watertight.
 - 4. Apply joint sealants at gutter joints per manufacturer's installation instructions and to meet the requirements of Section 07901 - Joint Sealants.
- D. Downspouts:
 - 1. Install downspouts, provide elbows and offsets, and secure downspouts to wall construction using downspout supports spaced no more than 10 feet insert spacing on center. Maximum distance of downspout support from top or bottom of downspout shall be 2 feet. Provide 45 degree elbow at bottom of downspout to direct water away from wall surface or foundation.
 - 2. Where downspout connects to building perimeter drainage system, lap downspout and perimeter drainage pipe a minimum of 3 inches.
 - 3. Install pre-cast concrete splash pans under downspouts.

3.3 CLEANING AND PROTECTION

- A. Remove damaged, defective or improperly installed materials. Replace with new materials installed per requirements of this section.
- B. Clean finished surfaces according to manufacturer's written instructions; maintain clean condition until Final Completion.

END OF SECTION

SECTION 07901

JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes joint sealants for the following locations:

- 1. Exterior Sight-Exposed Joint Applications:

- a. Metal-to-Metal expansion and control joints - two (2) part polyurethane or one (1) part silicone.
- b. Masonry-to-Masonry expansion and control joints - two (2) part polyurethane or one (1) part silicone.
- c. Connections between dissimilar materials (e.g., metal-to-masonry) - two (2) part polyurethane or one (1) part silicone.
- d. Perimeters of roof and wall openings - two (2) part polyurethane or one (1) part silicone with primer suitable for galvanized metals.
- e. Horizontal paving and traffic bearing joints - two (2) part polyurethane.
- f. Skylight panels and curbs - two (2) part polyurethane.
- g. Pipe, duct, and vent openings - one (1) part polyurethane.

- 2. Interior Sight-Exposed Joint Applications:

- a. Perimeters of doors and fixed windows - acrylic latex.
- b. Exposed masonry control joints - acrylic latex.
- c. Joints and recesses between metal frames and interior masonry - acrylic latex.
- d. Interior construction joints - acrylic latex.
- e. Joints at interior masonry that adjoin columns, pilasters, or exterior walls - acrylic latex.

- 3. Interior Concealed Applications:

- a. Joints in interior walls - acrylic latex or butyl based.
- b. Concealed masonry-to-floor structure joints - acrylic latex or butyl based.
- c. Exterior and interior metal thresholds, saddles, and sills - acrylic.
- d. Joints and recesses between access panels, electrical panels, piping, and pipe sleeves - one (1) part silicone.
- e. Fire Stops - acrylic latex with manufacturers fire blocking.
- f. Between metal frames and masonry substrates - acrylic latex.

SECTION 07901 JOINT SEALANTS

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. SECTION 07620 - SHEETMETAL FLASHING AND TRIM for sealing joints related to flashing and sheetmetal for roofing.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Specification Sections.

1. Product Data from manufacturers for each joint sealant product required.
2. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view. Color range must have available colors to match brick and mortar.
3. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

SECTION 07901 JOINT SEALANTS

1.07 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are more or less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.
- C. Acceptable Manufacturers (or equal):
 - 1. PECORA CORPORATION.
 - 2. TREMCO.
 - 3. SONNEBORN.
 - 4. DOW-CORNING.

2.02 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920 and other requirements indicated on each Elastomeric Joint Sealant Data Sheet at end of this Section, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.
- B. Additional Movement Capability: Where additional movement capability is specified in Elastomeric Joint Sealant Data Sheet, provide products with the

SECTION 07901 JOINT SEALANTS

capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

C. Products: Subject to compliance with requirements, provide one of the products specified in each Elastomeric Joint Sealant Data Sheet. Products listed are for use as example only. Contractor may provide products by the following manufacturers listed above that correspond to the same content and function as those listed below.

1. Dynatrol II - Two (2) part polyurethane: PECORA CORPORATION.
2. 864 Silicone - One (1) part neutral curing: PECORA CORPORATION.
3. NR 200 - Two (2) part, self-leveling polyurethane traffic-grade sealant: PECORA CORPORATION.

2.03 SOLVENT-RELEASE-CURING JOINT SEALANTS

A. Acrylic Sealant: Manufacturer's standard one (1) -part, non-sag, solvent-release-curing acrylic terpolymer sealant complying with AAMA 808.3 or FS TT-S-00230 or both, with capability when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage change in joint width existing at time of application and remain adhered to joint substrates indicated for Project without failing cohesively:

1. 12½% movement in both extension and compression for a total of 25%.

B. Pigmented Narrow Joint Sealant: Manufacturer's standard, solvent-release-curing, pigmented synthetic rubber sealant complying with AAMA 803.3 and formulated for sealing joints 3/16" or smaller in width.

1. Products: Subject to compliance with requirements, provide one (1) of the following:

a. Acrylic Sealant:

- 1) 60+Unicrylic, PECORA CORP.

b. Pigmented Narrow Joint Sealant:

- 1) PTI 200, PROTECTIVE TREATMENTS, INC.

2.04 LATEX JOINT SEALANTS

A. General: Provide manufacturer's standard one (1) -part, non-sag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.

SECTION 07901 JOINT SEALANTS

- B. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 that accommodates joint movement of not more than 5% in both extension and compression for a total of 10%.
- C. Available Products: Subject to compliance with requirements, latex joint sealants that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Products: Subject to compliance with requirements, provide one (1) of the following:
 - a. Acrylic-Emulsion Sealant:
 - 1) AC-20, PECORA CORP.

2.05 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and the following requirements:
 - 1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, non-drying, non-hardening, non-skinning, non-staining, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.
- C. Products: Subject to compliance with requirements, provide one (1) of the following:
 - 1. Acoustical Sealant:
 - a. AC-20 FTR Acoustical and Insulation Sealant, PECORA CORPORATION.
 - 2. Acoustical Sealant for Concealed Joints:
 - a. BA-98, PECORA CORPORATION.

2.06 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

SECTION 07901 JOINT SEALANTS

- B. Proprietary, reticulated, closed-cell polymeric foam, non-outgassing, with a density of 2.5 pcf (40 kg/cu. m) and tensile strength of 35 psi (240 kPa) per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.
- C. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, non-absorbent to water and gas, capable of remaining resilient at temperatures down to minus (-) 26 F (-32 °C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from pre-construction joint sealant-substrate tests and field tests.
- B. Cleaners for Non-Porous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent non-porous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer 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,

SECTION 07901 JOINT SEALANTS

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 concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 3. Remove laitance and form release agents from concrete.
 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
1. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
 2. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- B. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 2. Do not leave gaps between ends of joint fillers.

SECTION 07901 JOINT SEALANTS

3. Do not stretch, twist, puncture, or tear joint fillers.
 4. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
- C. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- D. Tooling of Non-Sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

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

3.05 PROTECTION

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

END OF SECTION

SECTION 07901 JOINT SEALANTS

SECTION 08710

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION

- A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install, all door hardware as shown on the Drawings and/or as specified herein.
- B. General Design: The materials specified herein are intended to be standard types of door hardware.

1.03 SUMMARY

- C. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. This Section includes the following:
 - 1. Hinges.
 - 2. Lock cylinders and keys.
 - 3. Lock and latch sets.
 - 4. Bolts.
 - 5. Closers.
 - 6. Overhead holders.
 - 7. Door trim units.
 - 8. Weather-stripping for exterior doors.
 - 9. Thresholds.
 - 10. Dome stops.
 - 11. Doors – See contract drawings for specification
- D. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. SECTION 07901 - JOINT SEALANTS.

SECTION 08710 DOOR HARDWARE

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Specification Sections.
1. Product Data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
 2. Final Hardware Schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 3. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - a. Type, style, function, size, and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each hardware set cross-referenced to indications on Drawings both on Floor Plans and in Door and Frame Schedule.
 - e. Explanation of all abbreviations, symbols, and codes contained in Schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.
 4. Submittal Sequence: Submit final Schedule at earliest possible date particularly where acceptance of Hardware Schedule must precede fabrication of other work that is critical in the Project construction Schedule. Include with Schedule the Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of Schedule.
- B. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

1.06 PRODUCT HANDLING

- A. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- B. Deliver individually packaged door hardware items promptly to place of installation (shop or Project Site).

SECTION 08710 DOOR HARDWARE

1.07 MAINTENANCE

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

1.08 REFERENCES

A. Door and Hardware Institute (DHI):

1. Keying Terminology.
2. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.
3. Recommended Locations for Architectural Hardware for Flush Wood Doors.
4. Sequence and Format for Hardware Schedules.
5. Recommended Procedure for Processing Hardware Schedules and Templates.

B. National Fire Protection Association (NFPA):

1. NFPA Bulletin No. 80 - Fire Doors and Frames.
2. NFPA Bulletin No. 101 - Life Safety Code.
3. NFPA Bulletin No. 105 - Smoke- and Draft-Control Door Assemblies.

C. American National Standards Institute (ANSI):

1. A117.1 - Providing Accessibility and Usability for Physically Handicapped People.
2. A156.18 - Materials and Finishes.

1.09 WARRANTY

- A. Provide manufacturer's written warranties on all items, except overhead closers, against failure due to defective materials and workmanship for a period of one (1) year and commencing on the date of Final Acceptance. In the event of such failure, promptly repair or replace at no additional cost to Owner.
- B. Provide manufacturer's written warranties on overhead door closers against failure due to defective materials and workmanship for a period of five (5) years commencing on the date of Final Acceptance. In the event of such failure, promptly repair or replace at no additional cost to Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Butts and Hinges (Stainless Steel):
 - a. HAGER HINGE COMPANY.
 - b. McKINNEY PRODUCTS COMPANY.
 - c. STANLEY HARDWARE, Division of STANLEY WORKS.
2. Cylinders and Locks.
 - a. BEST LOCK CORPORATION to meet County standards.
3. Bolts:
 - a. HAGER HINGE COMPANY.
 - b. H.B. IVES, A HARROW COMPANY.
 - c. STANLEY HARDWARE, Division of STANLEY WORKS.
4. Overhead Closers:
 - a. CORBIN & RUSSWIN ARCHITECTURAL HARDWARE, Division of BLACK & DECKER CORPORATION
 - b. LCN, Division of INGERSOLL-RAND DOOR HARDWARE GROUP.
 - c. MONARCH HARDWARE & MANUFACTURING COMPANY, Division of NEWMAN TONKS, INC.
 - d. RIXSON-FIREMARK, Division of YALE SECURITY, INC.
 - e. SARGENT.
5. Door Trim Units:
 - a. HAGER HINGE COMPANY.
 - b. H.B. IVES, A HARROW COMPANY.
 - c. TRIANGLE BRASS MANUFACTURING COMPANY (TRIMCO).
6. Door Weatherstripping and Seals:
 - a. HAGER HINGE COMPANY.
 - b. NATIONAL GUARD PRODUCTS, INC.
 - c. PEMKO MANUFACTURING CO., INC.
 - d. REESE ENTERPRISES, INC.
 - e. SEALEZE CORPORATION.

SECTION 08710 DOOR HARDWARE

7. Thresholds:

- f. HAGER HINGE COMPANY.
- g. NATIONAL GUARD PRODUCTS, INC.
- h. PEMKO MANUFACTURING CO., INC.
- i. REESE ENTERPRISES, INC.

8. Dome Stops:

- a. ROCKWOOD.
- b. H.B. IVES, A HARROW COMPANY.
- c. HAGER HINGE COMPANY.

9. Door Bottom:

- a. NATIONAL GUARD PRODUCTS, INC.
- b. PEMKO MANUFACTURING CO., INC.
- c. HAGER HINGE COMPANY.

10. Rain Drip:

- a. NATIONAL GUARD PRODUCTS, INC.
- b. PEMKO MANUFACTURING CO., INC.
- c. HAGER HINGE COMPANY.

11. Astragal:

- a. NATIONAL GUARD PRODUCTS, INC.
- b. PEMKO MANUFACTURING CO., INC.
- c. HAGER HINGE COMPANY.

2.02 SCHEDULED HARDWARE

- A. Manufacturer's Product Designations: The product designation and name of one (1) manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "MANUFACTURERS" in PART 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.

2.03 MATERIALS AND FABRICATION

- A. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indi-

SECTION 08710 DOOR HARDWARE

cated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

1. Provide stainless-steel finish on all exposed parts, unless noted otherwise..
- B. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
- C. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
- D. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the Work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the Work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.04 HINGES, BUTTS, AND PIVOTS

- A. Templates: Provide only template-produced units.
- B. Screws: Provide Phillips flat-head screws complying with the following requirements:
 1. Type as recommended by fiberglass door manufacturer.
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 1. Out-Swing Exterior Doors: Non-removable pins.
 2. Interior Doors: Non-rising pins.
- D. Number of Hinges: Provide number of hinges indicated but not less than three (3) hinges per door leaf for doors 90" or less in height and one (1) additional hinge for each 30" of additional height.
- E. Metals: Construct hinges, butts, and pivots from stainless steel.

2.05 LOCK CYLINDERS AND KEYING

- A. Review the keying system with the Owner and provide the type required (master, grandmaster or great-grandmaster), either new or integrated with Owner's existing system.

SECTION 08710 DOOR HARDWARE

- B. Equip locks with cylinders for interchangeable-core pin tumbler inserts. Furnish only temporary inserts for the construction period, and remove these when directed. Install final cores when temporary inserts removed.
- C. Metals: Construct lock cylinder parts from stainless steel only to the fullest extent possible.
- D. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.
 - 1. Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."
- E. Key Material: Provide keys of nickel silver only.
- F. Key Quantity: Furnish three (3) change keys for each lock, five (5) master keys for each master system, and five (5) grandmaster keys for each grandmaster system.
 - 1. Deliver keys to Owner.

2.06 LOCKS, LATCHES, AND BOLTS

- A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.
 - 1. Provide flat lip strikes for locks with three (3) -piece, anti-friction latchbolts as recommended by manufacturer.
 - 2. Provide recess-type top strikes for bolts locking into head frames, unless otherwise indicated.
- B. Lock Throw: Provide minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
 - 1. Provide 1/2" minimum throw of latch for other bored and preassembled types of locks and 3/4" minimum throw of latch for mortise locks. Provide 1" minimum throw for all dead bolts.
 - 2. Lock trim shall be supplied in compliance with A.D.A. Lever Design.
- C. Flush Bolt Heads: Minimum of 1/2"-diameter rods of brass, bronze, or stainless steel with minimum 12"-long rod for doors up to 7'-0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.

2.07 CLOSERS AND DOOR CONTROL DEVICES

SECTION 08710 DOOR HARDWARE

- A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.

- 1. Provide parallel arms for all overhead closers, except as otherwise indicated.

- B. Combination Door Closers and Holders: Provide units designed to hold door in open position under normal usage.

- C. Provide gray resilient parts for exposed bumpers.

2.08 WEATHERSTRIPPING AND SEALS

- A. General: Provide continuous weatherstripping on exterior doors. Provide non-corrosive fasteners for exterior applications and elsewhere as indicated.

- B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.

- C. Weatherstripping at Jambs and Heads: Provide bumper-type resilient insert and metal retainer strips, surface applied unless shown as mortised or semi-mortised, and of following metal, finish, and resilient bumper material:

- 1. Stainless-steel, 0.062" minimum thickness of main walls and flanges.

- D. Weatherstripping at Door Bottoms: Provide threshold consisting of contact-type resilient insert and metal housing of design and size shown and of following metal, finish, and resilient seal strip:

- 1. Stainless-steel, 0.062" minimum thickness of main walls and flanges.

2.09 THRESHOLDS

- A. General: Except as otherwise indicated, provide stainless steel threshold unit of type, size, and profile as shown or scheduled.

- 1. For out-swinging doors provide units with interlocking lip and with hook on bottom edge of door to act as weather bar.

2.10 HARDWARE FINISHES

- A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).

- B. Provide matching finishes for hardware units at each door opening to the greatest extent possible, and except as otherwise indicated. Reduce difference in color and texture as much as commercially possible where the base metal, or metal-forming

SECTION 08710 DOOR HARDWARE

process is different for individual units of hardware exposed at the same door of opening. In general, match items to the manufacturer's standard finish for the latch and lock (or push-pull units if no latch sets used) for color and texture.

- C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
 - 1. Recommended Locations for Builders Hardware for Standard Steel Doors and Frames by the Door and Hardware Institute.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in SECTION 07901 - JOINT SEALANTS.
- F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.02 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
 - 1. Where door hardware is installed more than one (1) month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hard-

SECTION 08710 DOOR HARDWARE

ware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

- B. Clean adjacent surfaces soiled by hardware installation.
- C. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.
- D. Six-Month Adjustment: Approximately six (6) months after the date of Substantial Completion, the Installer, accompanied by representatives of the manufacturers of latchsets and locksets and of door control devices, and of other major hardware suppliers, shall return to the Project to perform the following Work:
 - 1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
 - 2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.
 - 3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
 - 4. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

END OF SECTION

SECTION 08710 DOOR HARDWARE

SECTION 09250

GYPSUM DRYWALL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including GENERAL and SUPPLEMENTARY CONDITIONS and Specifications sections apply to work of this Section.

1.02 SUMMARY

- A. Extent of each type of gypsum drywall construction required is indicated on Drawings.
- B. This Section includes the following types of gypsum board construction:
 - 1. Steel framing members to receive gypsum board.
 - 2. Gypsum board screw-attached to steel framing and furring members.
 - 3. Remodeling at existing gypsum drywall construction.
 - 4. Gypsum sheathing for screw-attachment to steel framing.

1.03 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA 505 for definitions of terms for gypsum board construction not otherwise defined in this Section or other referenced standards.

1.04 SUBMITTALS

- A. Product data from manufacturers for each type of product specified.

1.05 QUALITY ASSURANCE

- A. Fire-Resistance Ratings: Where indicated, provide materials and construction which are identical to those of assemblies whose fire-resistance rating has been determined per ASTM E 119 by a testing and inspecting organization acceptable to authorities having jurisdiction.
- B. Provide fire-resistance-rated assemblies identical to those indicated by reference to design designations in UL Fire Resistance Directory.
- C. Single-Source Responsibility: Obtain each type of gypsum board and related joint treatment materials from a single manufacturer.

SECTION 09250 GYPSUM DRYWALL

1.06 DELIVERY-STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner-beads and trim.

1.07 PROJECT CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for application and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.
- B. Minimum Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40 F (4 C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 F (10 C) for forty-eight (48) hours prior to application and continuously thereafter until drying is complete.
- C. Ventilate building spaces to remove water not required for drying joint treatment materials. Avoid drafts during dry, hot weather to prevent materials from drying too rapidly.

1.08 SPECIAL REQUIREMENTS

- A. Labeling of Rated Walls:
 - 1. All walls indicated below shall be labeled (marked) using red enamel paint. Labels shall be placed above the ceiling within 12" above the finished ceiling plane.
 - 2. Letter size shall be 2" in height. Labels shall run horizontally with the wall. Block-style capital letters shall be used. Letters shall be stenciled.
 - 3. Label both sides of walls. Label walls 20' on center along single walls and at least once for walls less than 20' in length.
 - a. One (1) -Hour Walls Around Rooms: 1-HOUR FIRE WALL, PROTECT ALL PENETRATIONS.
 - b. All Two (2) -Hour Fire Partitions: 2-HOUR FIRE WALL, PROTECT ALL PENETRATIONS.

SECTION 09250 GYPSUM DRYWALL

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Steel Framing and Furring:

- a. DIETRICH INDUSTRIES, INC.
- b. DALE/INCOR.
- c. GOLD BOND BUILDING PRODUCTS DIVISION, NATIONAL GYPSUM COMPANY.
- d. CLARK STEEL FRAMING SYSTEMS.
- e. UNITED STATES GYPSUM COMPANY.

2. Gypsum Boards and Related Products:

- a. GEORGIA-PACIFIC CORPORATION.
- b. GOLD BOND BUILDING PRODUCTS DIVISION, NATIONAL GYPSUM COMPANY.
- c. UNITED STATES GYPSUM COMPANY.

2.02 GYPSUM BOARD

A. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end joints.

B. Gypsum Wallboard: ASTM C 630, and as follows:

1. Type: Moisture Resistant (Green Board), unless otherwise indicated.
2. Type: Type "X" for fire-resistance-rated assemblies.
3. Edges: Tapered and featured (rounded or beveled) for pre-filling.
4. Thickness: 5/8", unless otherwise indicated.

2.03 TRIM ACCESSORIES

A. Corner-bead and Edge Trim for Interior Installation: Provide corner beads, edge trim, and control joints which comply with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal, plastic, or metal combined with paper, with metal complying with the following requirements:
 - a. Sheet steel zinc-coated by hot-dip process.
 - b. Edge strip shapes indicated below by reference to designations of UNITED STATES GYPSUM COMPANY.

SECTION 09250 GYPSUM DRYWALL

- i. One-Piece Control Joint: Formed with V-shaped slot per UNITED STATES GYPSUM COMPANY, No. 903, with slot opening covered with removable strip.
- ii. C-shaped bead, UNITED STATES GYPSUM COMPANY, No. 200-A or 200-B.

2.04 GYPSUM BOARD JOINT TREATMENT MATERIALS

- A. General: Provide materials complying with ASTM C 475, ASTM C 840, and recommendations of manufacturer of both gypsum board and joint treatment materials for the application indicated.
- B. Joint Tape: Paper reinforcing-tape, unless otherwise indicated.
 1. Use pressure-sensitive or staple-attached open-weave glass fiber reinforcing-tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.
- C. Setting-Type Joint Compounds: Factory-pre-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
 1. Where setting-type joint compounds are indicated for use as taping and topping compounds, use formulation for each which develops greatest bond strength and crack resistance and is compatible with other joint compounds applied over it.
 2. For pre-filling gypsum board joints, use formulation recommended by gypsum board manufacturer.
 3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer for this purpose.

2.05 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum drywall construction which comply with referenced standards and the recommendations of the manufacturer of the gypsum board.
- B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum boards.
- C. Spot Grout: ASTM C 475, setting-type joint compound of type recommended for spot grouting hollow metal door frames.
- D. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum boards to steel framing.
- E. Gypsum Board Screws: ASTM C 1002.

SECTION 09250 GYPSUM DRYWALL

- F. Asphalt Felt: ASTM D 226, Type I (No. 15).
- G. Concealed Acoustical Sealant: Non-drying, non-hardening, non-skinning, non-staining, non-bleeding, sealant complying with requirements specified in SECTION 07901 - JOINT SEALANTS.
- H. Thermal Insulation: Material indicated below, of thickness and width to fill voids formed by Z-furring members:
 - 1. Unfaced Mineral Fiber Blanket Insulation: Unfaced mineral fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing); and as follows:
 - a. Mineral Fiber Type: Fibers manufactured from glass.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates to which drywall construction attaches or abuts, preset hollow metal frames, cast-in anchors, and structural framing, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of drywall construction. Do not proceed with installation until satisfactory conditions have been corrected.

3.02 PARTITION CONSTRUCTION/INSTALLATION

- A. Where partitions of different fire-resistant rating interact, the partition with the higher fire rating requirement shall be completely enclosed and isolated from other partitions. The gypsum wallboard of the higher-rated partition shall continue uninterrupted through the intersection.
 - 1. Two (2) -hour partitions shall be enclosed and isolated from all one (1) -hour-rated and non-rated partitions.
 - 2. One (1) -hour partitions shall be enclosed and isolated from corridor partitions and non-rated partitions.

3.03 INSTALLATION OF STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in the Work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer, or if not available, with

SECTION 09250 GYPSUM DRYWALL

- C. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement at locations indicated below, to comply with details shown on Drawings:
 - 1. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.
 - 2. Where partition and wall framing abuts overhead structure.
 - a. Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading.
- D. Do not bridge building expansion and control joints with steel framing or furring members; independently from both sides of joints with framing or furring members, or as indicated.
- E. Secure all other studs to floor runner by stud-clinching tool on both flanges of studs or by screws.
- F. Provide a slip- or cushion-type joint of type as recommended by stud manufacturer where ceiling track is anchored to prevent transfer of structural load of deflection to stud system.
- G. Provide metal framing (headers and side supports) at rated walls and partitions where ductwork, multiple piping, and multiple electrical conduit penetrations occur.

3.04 APPLICATION AND FINISHING OF GYPSUM BOARD, GENERAL

- A. Gypsum Board Application and Finishing Standard: Install and finish gypsum board to comply with ASTM C 840.
- B. Install sound-attenuation blankets where indicated, prior to gypsum board unless readily installed after board has been installed.
- C. Locate exposed end-butt joints as far as from center of walls and ceilings as possible, and stagger not less than 24" in alternate courses of board.
- D. Install ceiling boards across framing in the manner which minimizes the number of end-butt joints, and which avoids end joints in the central area of each ceiling. Stagger end joints at least 24".
- E. Install wall/partition boards in a manner which minimizes the number of end-but joints or avoids them entirely where possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.

SECTION 09250 GYPSUM DRYWALL

- F. Install exposed gypsum board with face side out. Do not install imperfect, damaged, or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
- G. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges, and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
- H. Attach gypsum board to steel studs so that leading edge or end of each board is attached to open (unsupported) edge of stud flange first.
- I. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
- J. Spot-grout hollow metal doors frames for solid core wood doors, hollow metal doors, and doors over 32" wide. Apply spot-grout at each jamb anchor clip just before inserting board into frame.
- K. Form control joints and expansion joints at locations indicated, with spaces between edges of boards, prepared to receive trim accessories.
- L. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are braced internally.
 - 1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than eight (8) square feet area, and may be limited to not less than 75% of full coverage.
 - 2. Fit gypsum board around ducts, pipes, and conduits.
 - 3. Where rated partitions intersect metal decking, cut gypsum board to fit profile of decking and to allow ¼"- to ½"-wide joint for sealant.
- M. Isolate perimeter of non-load-bearing drywall partitions of structural abutments. Provide ¼" to ½" space and trim edge with U-bead edge trim. Seal joints with acoustical sealant.
- N. Space fasteners in gypsum boards in accordance with referenced gypsum board application and finishing standards and manufacturer's recommendations.
- O. Horizontal joints (top and bottom) and vertical (end) joints where gypsum wall-board intersects the ceiling, floor, and walls shall be a minimum of ¼" to a maximum of ½" wide.

SECTION 09250 GYPSUM DRYWALL

1. Joints larger than ½" will not be accepted as satisfactory Work. Should this occur, the wallboard shall be removed and replaced with wallboard having the specified joint dimension.

P. Application of Sealants: Seal joints, full depth of wallboard, as follows:

1. Horizontal (Top and Bottom) Joints, ¼" to ½" Wide: Acoustical sealant.
2. Horizontal (Top and Bottom) Joints, More than ½" Wide: Acoustical sealant.

Q. Vertical Joints: Fire-barrier sealant.

R. Provide gypsum wallboard on both sides of all partition studs above ceiling to structure above, unless otherwise indicated.

S. Wallboard shall not be cantilevered more than 6" in any direction, without additional metal framing reinforcement.

T. Installation of Moisture-Resistant Gypsum Wallboard: Install in toilet rooms and janitor closets.

3.05 METHODS OF GYPSUM BOARD APPLICATION

A. Single-Layer Application: Install gypsum board as follows:

1. On ceilings, apply gypsum board prior to wall/partition board application to greatest extent possible.
2. On partitions/walls, apply gypsum board vertically (parallel to framing), unless otherwise indicated, and provide sheet lengths which will minimize end joints.

B. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:

1. Fasten with screws.

C. Multi-Layer Fastening Methods: Fasten base layer and face layer separately to supports with screws.

3.06 INSTALLATION OF DRYWALL TRIM ACCESSORIES

A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

B. Install corner beads at external corners.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where U-bead (semi-finishing-type) is indicated.

SECTION 09250 GYPSUM DRYWALL

- D. Install control joints at locations indicated, or if not indicated, at spacings and locations required by referenced gypsum Board application-and-finish standards, and approved by the Architect for visual effect.
- E. Install metal trim (casing bead) where gypsum wallboard butts other materials and at exposed edges or ends.
- F. Blow-out Patches: Oversize penetrations through smoke or fire walls, pipe, conduit, and similar items shall be installed as indicated on sketches attached to the end of this Section. Penetration of bar joist through smoke- or fire-walls shall be framed and treated as indicated on sketches attached to the end of this Section.

3.07 FINISHING OF DRYWALL

- A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare Work for decoration.
- B. Pre-fill open joints and rounded or beveled edges, if any, using setting-type joint compound.
- C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.
- D. Finish interior gypsum wallboard by applying the following joint compounds in three (3) coats (not including pre-fill of openings in base), and sand between coats and after last coat.
 - 1. Embedding and First Coat: Ready-mix, setting-type all-purpose or taping compound.
 - 2. Fill (Second) Coat: Ready-mix, setting-type all-purpose or topping compound.
 - 3. Finish (Third) Coat: Ready-mix, setting-type all-purpose or topping compound.
- E. Partial Finishing: Omit third coat and sanding on concealed drywall construction which is indicated for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

SECTION 09250 GYPSUM DRYWALL

F. Provide levels of finish as follows:

1. Finish for Surfaces Exposed to View: Level 4.
2. Finish for Surfaces Exposed to Plenum: Level 2.
3. Unexposed Surfaces: Level 1.
4. Provide Level 5 finish where epoxy paint is specified, and where indicated.

3.08 PROTECTION

- A. Provide final protection and maintain conditions, in a manner suitable to installer, which ensures gypsum drywall construction being without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 09670

SLIP RETARDANT FLOOR COATING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Submit Product Data and color Samples.

1.02 WORK INCLUDED

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete slip-retardant floor coating as selected on drawings and/or specified herein.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Specification Sections.
- B. Product Data: Submit manufacturer's technical data, application instructions and general recommendations for slip-retardant coating floor coating specified herein.
- C. Samples:
 - 1. Submit 2-1/2" x 4" samples in color and profile as selected.
- D. Material certificates signed by manufacturer certifying that the slip-retardant coating floor coating complies with requirements specified herein.
- E. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer or applicator who has specialized in installing resinous flooring types similar to that required for this Project and who is acceptable to manufacturer of primary materials.
- B. Single-Source Responsibility: Obtain floor coating materials including primers, slip-retardant aggregates, resins, hardening agents and finish coats, from a single manufacturer.

SECTION 09670 SLIP RETARDANT FLOOR COVERING

1.05 DELIVERY STORAGE AND HANDLING

- A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name and directions for storage and mixing with other components.
- B. Store materials to comply with manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Comply with slip-retardant coating manufacturer's directions for maintenance of ambient and substrate temperature, moisture, humidity, ventilation, and other conditions required to execute and protect work.
- B. Lighting: Permanent lighting will be in place and working before installing floor coating.

PART 2 - PRODUCTS

2.01 SLIP RETARDANT FLOOR COATING

- A. Epicote Epoxy Slip resistant floor coating 79000 series.
- B. Slip-retardant epoxy coating shall be Dex-O-Tex Posi-Tred "O" as manufactured by Crossfield Products Corp., Rancho Dominguez, California; Roselle Park, New Jersey; Hinsdale, Illinois; Moss Point, Mississippi; Tacoma, Washington.
- C. General Polymers Water-based Abrasion Resistant Floor Coating System as manufactured by Sherwin-Williams consisting of 3460 AquArmor WBE as primer, base coat 3460 AquArmor WBE, and 4410 AQUARMOR WB Urethane with 5240 White Aluminum Oxide 220 mesh. The total system thickness will be 10-25 mils WFT nominal.

2.02 PROPERTIES

- A. Colors: As indicated, or if not otherwise indicated, as selected by design professional from manufacturer's standard colors which must include white, gray and off-white.
- B. Physical Properties: Provide floor coating system that meets or exceeds the listed minimum physical property requirements when tested according to the referenced standard test method in parentheses.
 - 1. Overall Thickness (Dry Film) to Top of Slip-Retardant Aggregate
 - a) Fine Profile - 12 mils
 - b) Medium Profile - 23 mils
 - c) Coarse Profile - 54 mils
 - d) Very Coarse Profile - 65 mils

SECTION 09670 SLIP RETARDANT FLOOR COVERING

2. Coefficient of Friction – Rubber Shoe Surface
 - a) Medium Profile .60 .63
3. Chemical Resistance - (ASTM D-1308) - (Spot-Test Open - 24 Hours)
 - a) Citric Acid (70%) - No Effect
 - b) Hydrochloric Acid (10%) - No Effect
 - c) Sulfuric Acid (50%) - No Effect
 - d) Sodium Hydroxide (5%) - No Effect
 - e) Lactic Acid - Discoloration
 - f) Beef and Bacon Fat - No Effect
 - g) Hydraulic Fluid - No Effect
 - h) Urine - No Effect
 - i) Resistance to Immersion - (MIL-D-23003A, Para. 4.6.11)
 - j) SAE 10 Oil; Detergent Solution - No softening, loss of adhesion or other form of deterioration
 - k) Fire Resistance - (ASTM E-162)
 - l) Flame Spread Index – 0
 - m) Smoke Deposited – 2 mg

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Apply each component of the Slip Retardant Floor Coating System in compliance with manufacturer's written installation instructions and strictly adhere to mixing and installation methods, recoat windows, cure times and environmental restrictions.
- B. Examine the areas and condition where slip-retardant epoxy floor coating is to be installed and notify the design professional of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory Conditions have been corrected by the Contractor in conformance with the Contract Documents.

3.02 PREPARATION

- A. Substrate: Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring application.
- B. Concrete Surfaces: Shot-blast, acid etch or power scarify as required to obtain optimum bond of flooring to concrete. Remove sufficient material to provide a sound surface free of laitance, glaze, efflorescence, and any bond-inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminants. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust, dirt, laitance, and efflorescence.
- C. Materials: Mix epoxy primer and urethane coating components when required and prepare materials according to manufacturer's instructions.

SECTION 09670 SLIP RETARDANT FLOOR COVERING

3.03 APPLICATION

- A. General: Apply each component of slip-retardant epoxy coating service floor coating system according to manufacturer's directions to produce a uniform, monolithic flooring surface.
- B. Bond Coat: Apply epoxy bond coat over prepared substrate at manufacturer's recommended spreading rate by squeegee, trowel or spray.

3.04 CURING PROTECTION AND CLEANING

- A. Cure floor coating materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.

END OF SECTION

SECTION 09865
SURFACE PREPARATION AND SHOP PRIME PAINTING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section specifies the labor, materials, equipment and incidentals required for the surface preparation and application of shop primers on ferrous metals, excluding stainless steel, as specified herein.

1.02 RELATED WORK

- A. Field painting is included in Section 09900 "Painting."

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the OWNER for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Submit to the OWNER for review and comment manufacturer's specifications and data on the proposed primers and detailed surface preparation, application procedures and dry mil thickness.
- C. Submit representative physical samples of the proposed primers, if required by the OWNER.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Submerged Services: Shop primer for ferrous metals which will be submerged or which are subject to splash action or which are specified to be considered submerged service shall be sprayed with 1 coat of Glidden Epoxy High Build Primer 5461/5452, or an acceptable equal, at a minimum dry film thickness of 5.0-mils.
- B. Non-submerged Services: Shop primer for ferrous metals, other than those covered by Paragraph 2.01 A, shall be sprayed with 1 coat of Glidden T&S Primer 5205, or an acceptable equal, at a minimum dry film thickness of 2.0-mils.
- C. Non-primed Surfaces: Gears, bearing surfaces and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during all

periods of storage and erection and shall be satisfactory to the OWNER up to the time of the final acceptance test.

- D. Compatibility of Coating System: Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with their corresponding primers and finish coats specified in Section 09900 "Painting" for use in the field and which are recommended for use together.

PART 3 - EXECUTION

3.01 APPLICATION

A. Surface Preparation and Priming

1. Non-submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC SP 6, Commercial Grade, immediately prior to priming. Submerged components scheduled for priming, as defined above, shall be sandblasted clean in accordance with SSPC SP 10, immediately prior to priming.
2. Surfaces shall be dry and free of dust, oil, grease, dirt, rust, loose mill scale, and other foreign material before priming.
3. Shop prime in accordance with acceptable paint manufacturer's recommendations.
4. Priming shall follow sandblasting before any evidence of corrosion has occurred and within 24-hours.

END OF SECTION

SECTION 09900

PAINTING – MUNICIPAL WASTEWATER COLLECTION BUILDING

PART 1 -GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

1.02 SUMMARY

- A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.
- B. Paint all exposed surfaces whether or not colors are designated in schedules or in the drawings or this section, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated in the drawings or this section, the Owner will select from standard colors or finishes available.
 - 1. Painting includes field-painting exposed bare and covered pipes and ducts, hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
 - 1. Pre-finished items not to be painted include the following factory-finished components:
 - a. Finished mechanical and electrical equipment unless noted otherwise.
 - b. Light fixtures.
 - c. Switchgear.
 - d. Distribution cabinets.
 - e. Fire-extinguishers and mounting hardware.
 - f. Aluminum doors and frames.
 - 2. Finished metal surfaces not to be painted include:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper.
 - e. Bronze.
 - f. Brass.
 - g. Galvalume.
 - 3. Operating parts not to be painted include moving parts of operating equipment, such as the following:
 - a. Valve-and damper-operators.
 - b. Linkages.

SECTION 09900 PAINTING

- c. Sensing devices.
 - d. Motor and fan shafts.
- 4. Labels: Do not paint over Underwriters Laboratories', Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections: The following Sections contain requirements that relate to this Section:
09865 Surface Preparations and Shop Prime Painting

1.03 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Specification Sections.
 - 1. Product Data for each paint system specified, including block fillers and Primers.
 - a. Provide the manufacturer's technical information including label analysis and instructions for handling, storage, and application of each material proposed for use.
 - b. List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.
- B. Samples for each finish and for each color and texture are required. Provide initial color selection in the form of manufacturer's color charts, if applicable.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to those indicated for the Project that have resulted in a construction record of successful in-service performance.
- B. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- C. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface until required sheen, color, and texture are obtained; simulate finished lighting conditions for review of in-place work.
 - a. Final acceptance of colors will be from job-applied samples
- D. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touchup procedures, and color samples of each color and finish used

SECTION 09900 PAINTING

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Job Site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 F (7 C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.06 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 F (10 C) and 90 F (32 C).
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 F (7 C) and 95 F (35 C).
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or at temperatures less than 5 F (3 C) above the dew point; or to damp or wet surfaces.

PART 2-PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:
 - 1. SHERWIN WILLIAMS COMPANY

2.02 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate

SECTION 09900 PAINTING

colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish the manufacturer's material data and certificates of performance for proposed substitutions.

- C. Colors: Provide color selections made by Owner from the manufacturer's full range of standard colors.

2.03 MASONRY BLOCK FILLER

- A. Filler Coat Materials: Provide the manufacturer's recommended factory-formulated, latex-type concrete masonry block fillers that are compatible with the finish materials indicated.

2.04 PRIMERS

- A. Primers: Provide the manufacturer's recommended factory-formulated primers that are compatible with the substrate and finish coats indicated.

2.05 UNDERCOAT MATERIALS

- A. Undercoat Materials: Provide the manufacturer's recommended factory-formulated undercoat materials that are compatible with the substrate and finish coats indicated.

2.06 EXTERIOR FINISH PAINT MATERIAL

- A. Finish Paint: Provide the manufacturer's recommended factory-formulated finish-coat materials that are compatible with the substrate and undercoats indicated.

2.07 INTERIOR FINISH PAINT MATERIAL

- A. Finish Paint: Provide the manufacturer's recommended factory-formulated finish-coat materials that are compatible with the substrate and undercoats indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with paint application requirements. Surfaces receiving paint must be thoroughly dry before paint is applied.
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Owner about anticipated problems using the materials specified over

SECTION 09900 PAINTING

substrates primed by others.

3.02 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, to completely paint the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to the manufacturer's instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and re-prime. Notify Owner in writing about anticipated problems using the specified finish-coat material with substrates primed by others.
 - 2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and bum, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow drying, and vacuuming before painting.
 - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - 4. Ferrous Metals: Clean un-galvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council (SSPC).
 - a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

SECTION 09900 PAINTING

- b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
- 5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Carefully mix and prepare paint materials according to manufacturer's directions.
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
 - 3. Use only thinners approved by the paint manufacturer and only within recommended limits.

3.03 APPLICATION

- A. General: Apply paint according to manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film
 - 1. Paint colors, surface treatments, and finishes are indicated in the Schedules or on the Drawings.
 - 2. Provide finish coats that are compatible with primers and sealers used.
 - 3. Spray painting must be scheduled with other trades so as not to be a hazard.
 - 4. The number of coats and the film thickness required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce a smooth even surface according to the manufacturer's directions.
 - 5. Apply additional coats if undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
 - 6. The term exposed surfaces includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 - 7. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 8. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
 - 9. Sand lightly between each succeeding enamel and/or varnish coat.

SECTION 09900 PAINTING

10. Omit primer on metal surfaces that have been shop-primed and touch-up painted.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- D. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to the manufacturer's directions.
 1. Brushes: Use brushes best suited for the material applied.
 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- E. Minimum Coating Thickness: Apply materials no thinner than the manufacturers recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- F. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.
- G. Mechanical items to be painted include, but are not limited to, the following:
 1. Piping, pipe hangers, and supports.
 2. Tanks.
 3. Ductwork.
 4. Supports.
 5. Motors and mechanical equipment.
 6. Accessory items.
- H. Electrical items to be painted include, but are not limited to, the following:
 1. Conduit and fittings.
 2. Switchgear.
- I. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- J. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime-coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no bum-through or other defects due to insufficient sealing.
- K. Pigmented (Opaque) Finishes: Completely cover to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
- L. Provide satin finish for final coats.
- M. Completed Work: Match approved samples for color, texture, and coverage. Remove, re-finish, or re-paint work not complying with specified requirements.

SECTION 09900 PAINTING

3.04 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the Site.
- B. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.05 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Owner.
- B. Provide "Wet Paint" signs to protect newly-painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR PAINT SCHEDULE

- A. General: provide the following paint systems for the various substrates indicated.
- B. Stucco
 - a. Areas to be painted: all exterior masonry elevations and previously painted metal pipes, utility boxes, vents.
 - i. Primer – Sherwin Williams’s acrylic masonry conditioner LX03 series according to manufacturer’s label directions.
 - ii. First coat – Sherwin Williams Loxon Self Cleaning Acrylic Coating exterior satin LX 14 series at recommended film thickness according to manufacturer’s label directions.
 - iii. Finish coat – Sherwin Williams Loxon Self Cleaning Acrylic exterior satin LX 14 series at recommended film thickness according to manufacturer’s label directions.
- C. PVC
 - a. Areas to be painted: all exterior PVC to be painted.
 - i. Primer – Sherwin Williams Extreme Bond Int/Ext Primer B51 Series according to manufacturer's label directions.
 - ii. First coat – Sherwin Williams Loxon Self Cleaning Acrylic Coating exterior satin LX 14 series at recommended film thickness according to manufacturer’s label directions.
 - iii. Finish coat – Sherwin Williams Loxon Self Cleaning Acrylic exterior satin LX 14 series at recommended film thickness according to manufacturer’s label directions.
- D. Metal
 - a. Areas to be painted: all common area doors and door frames, louvers,

SECTION 09900 PAINTING

pump-outs and any exterior metal surfaces not included above and below.

- i. Primer - Sherwin Williams Macropoxy 646-100 Fast Cure Epoxy B58 series as recommended film thickness according to manufacturer's label directions.
- ii. First coat – Sherwin Williams Hi-Solids Polyurethane (Mildew Resistance) gloss enamel B65WW305 series at recommended film thickness according to manufacturer's label directions.
- iii. Finish coat – Sherwin Williams Hi-Solids Polyurethane (Mildew Resistance) gloss enamel B65WW305 series at recommended film thickness according to manufacturer's label directions.

E. Exterior wood

- a. Areas to be painted: all wood surfaces to be painted.
 - i. Primer - Sherwin Williams Fast Drying Int/Ext Oil-Based Primer Y24 Series as recommended film thickness according to manufacturer's label directions (on all unpainted wood surfaces to be painted).
 - ii. First coat – Sherwin Williams Loxon Self Cleaning Acrylic Coating exterior semi-gloss LX 14 series at recommended film thickness according to manufacturer's label directions.
 - iii. Finish coat – Sherwin Williams Loxon Self Cleaning Acrylic exterior semi-gloss LX 14 series at recommended film thickness according to manufacturer's label directions.

3.07 INTERIOR PAINT SCHEDULE

A. General: provide the following paint systems for the various substrates, as indicated.

B. Interior walls and ceiling – drywall (gypsum)

- a. Areas to be painted: all interior walls
 - i. Primer – Sherwin Williams ProMar200 Zero VOC latex primer sealer B28 series according to manufacturer's label directions.
 - ii. First coat - Sherwin Williams Pro Industrial Pre-Catalyzed WB Single-Component Epoxy interior eggshell finish K45 series at recommended film thickness according to manufacturer's label directions.
 - iii. Finish coat – Sherwin Williams Pro Industrial Pre-Catalyzed WB Single-Component Epoxy eggshell finish K45 series at recommended film thickness according to manufacturer's label directions.

C. Interior concrete blocks (cmu)

- a. Areas to be painted: all interior concrete blocks to be painted.
 - i. Primer – Sherwin Williams PreRite Block Filler B25W25 series according to manufacturer's label directions.
 - ii. First coat - Sherwin Williams Pro Industrial Pre-Catalyzed WB Single-Component Epoxy interior eggshell finish K45 series at recommended film thickness according to manufacturer's label

SECTION 09900 PAINTING

directions.

- iii. Finish coat – Sherwin Williams Pro Industrial Pre-Catalyzed WB Single-Component Epoxy eggshell finish K45 series at recommended film thickness according to manufacturer's label directions.

D. Interior metal

- a. Areas to be painted: all interior metal to be painted.
 - i. Primer - Sherwin Williams Macropoxy 646-100 Fast Cure Epoxy B58 series as recommended film thickness according to manufacturer's label directions.
 - ii. First coat – Sherwin Williams Hi-Solids Polyurethane (Mildew Resistance) gloss enamel B65WW305 series at recommended film thickness according to manufacturer's label directions.
Finish coat –Sherwin Williams Hi-Solids Polyurethane (Mildew Resistance) gloss enamel B65WW305 series at recommended film thickness according to manufacturer's label directions

E. Interior wood

- a. Areas to be painted: all interior wood to be painted.
 - i. Primer - Sherwin Williams Fast Drying Int/Ext Oil-Based Primer Y24 Series as recommended film thickness according to manufacturer's label directions (on all unpainted wood surfaces to be painted).
 - ii. First coat - Sherwin Williams Pro Industrial Pre-Catalyzed WB Single-Component Epoxy interior semi-gloss finish K45 series at recommended film thickness according to manufacturer's label directions.
 - iii. Finish coat – Sherwin Williams Pro Industrial Pre-Catalyzed WB Single-Component Epoxy semi-gloss finish K45 series at recommended film thickness according to manufacturer's label directions.

END OF SECTION

SECTION 09900 PAINTING

SECTION 10200

LOUVERS

PART 1 -GENERAL

1.01 SUMMARY

- A. Provide louvers as shown in the drawings and as specified herein.

1.02 PERFORMANCE REQUIREMENTS

- A. General: Comply with performance requirements indicated as demonstrated by testing according to AMCA 500-L.

1.03 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Specification Sections.
 - 1. Provide the manufacturer's technical information and Product Data for each louver specified.
 - 2. Proof of Florida product or NOA certification.

PART 2-PRODUCTS

2.01 LOUVERS

- A. Basis of Design: The design for each louver is based on the product named in the drawings.

2.1 MATERIALS

- A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions.
- B. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel.

2.3 LOUVER SCREENS

- A. Provide insect screen at interior face of each exterior louver. Fabricate screen frames from same kind and form of metal as indicated for louver to which screens are attached.
 - 1. Screening: Aluminum mesh.

2.4 FINISHES

- A. Aluminum Louvers: High-performance organic coating finish, AA-C12C42R1x. Use manufacturer's standard 2 -coat fluoropolymer system complying with AAMA

2605, with finish coats containing at least 70 percent polyvinylidene fluoride resin by weight.

2.5 SECURITY

- A. Provide security bars on the interior face of each exterior louver. Security bars shall be provided by the louver manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible.
- C. Protect metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

END OF SECTION

SECTION 15060

PIPE PENETRATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. Under this section there shall be furnished and installed a complete Link-Seal® Modular Seal assembly, manufactured by PSI/Thunderline/Link-Seal located at 6525 Goforth Street, Houston, TX 77021, as shown on drawings and specifications. For clarification, complete assembly is defined as a combined:
1. Wall opening (i.e. steel sleeve, Thermoplastic (HDPE) sleeve, cored hole or formed hole). The wall opening size and/or type shall be selected according to recommendations found in the most recent Link-Seal Modular Seal catalog.
 2. Sufficient quantity and type of Link-Seal Modular Seals required to effectively provide a hydrostatic and/or fire-rated seal.
 3. Each individual link shall be conspicuously and permanently identified with the name of the manufacturer and model number. Manufacturers other than the above-named company wishing to quote equipment in this section shall submit detail drawings of their proposed equipment and suitable evidence of experience and results to the engineer to obtain written approval to quote at least ten (10) days prior to bid opening.

PART 2 – PRODUCTS

2.01 MATERIALS

A. LINK-SEAL® MODULAR SEAL RUBBER LINKS

Seals shall be modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM. Coloration shall be throughout elastomer for positive field inspection.

1. For Standard Service Applications
 - a. -40 to +250°F (-40 to +121°C)
 - b. EPDM = ATSM D2000 M3 BA510
 - c. Color = Black
2. For Hydrocarbon Service Applications
 - a. -40 to +210°F (-40 to +99°C)
 - b. Nitrile = ASTM D2000 M1BF510
 - c. Color = Green

SECTION 15060 PIPE PENETRATIONS

3. For High Temperature or Fire Seal Applications
 - a. -67 to +400°F (-55 to +204°C)
 - b. Silicone = ASTM D2000 M1GE505
 - c. Color = Gray

Note: Reference shall always be made to the latest published Link-Seal Modular Seal Selection Guide for the service intended.

B. LINK-SEAL® MODULAR SEAL PRESSURE PLATES

1. Link-Seal Modular Seal pressure plates shall be molded of glass reinforced nylon. Models LS200-275-300-315 shall incorporate the most current Link-Seal Modular Seal design modifications and shall include an integrally molded compression assist boss on the top (bolt entry side) of the pressure plate, which permits increased compressive loading of the rubber sealing element. Models 325-400- 425-475-500-525-575-600 shall incorporate an integral recess known as a "Hex Nut Interlock" designed to accommodate commercially available fasteners to insure proper thread engagement for the class and service of metal hardware.
2. For fire and Hi-Temp service, pressure plates shall be steel with 2-part Zinc Dichromate and Organic Coating.

C. LINK-SEAL MODULAR SEAL HARDWARE

All fasteners shall be sized according to latest Link-Seal Modular Seal technical data. Bolts, flange hex nuts shall be either:

- b. 316 Stainless Steel

PART 3 CONSTRUCTION - WALL OPENING

A. CENTURY LINE SLEEVES

1. Where pipes must pass through walls and floors of new structures, unless otherwise shown or specified, install molded non-metallic high density polyethylene Model CS CenturyLine Sleeves as manufactured by PSI/Thunderline/Link-Seal. CS sleeves shall have integrally formed water stop sized a minimum of four inches larger than the outside diameter of the sleeve itself. Each sleeve assembly shall have end caps manufactured of the same material as the sleeve itself and installed at each end of the sleeve so as to prevent deformation during the initial concrete pour, and to facilitate attaching the sleeve to the wall forms. End caps shall remain in place to protect the opening from residual debris and rodent entry prior to pipe insertion.

SECTION 15060 PIPE PENETRATIONS

B. CELL-CAST® DISKS

2. The contractor shall install Cell-Cast Disks, providing a round hole in conformance with Link-Seal Modular Seal sizing data. Cell-Cast Disks shall consist of 3" and/or 4" lightweight interlocking polyethylene cells stacked to form the thickness of the poured concrete wall. Molded into each cell shall be a cavity to accept a 2" x 4" nailer.

PART 4 QUALITY ASSURANCE

- A. Link-Seal Modular Seal components and systems shall be manufactured at a plant with a current ISO-9002 registration.

END OF SECTION

SECTION 15062
DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install, all ductile iron piping, ductile iron fittings, and appurtenances as shown on the Drawings and/or as specified herein.
- B. General Design: The equipment and materials specified herein are intended to be standard types of ductile iron pipe and cast or ductile iron fittings for use in transporting wastewater, potable water, and reclaimed water.

1.02 QUALITY ASSURANCE

- A. Qualifications: All of the ductile iron pipe and ductile or cast iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.
- B. Standards:
 - 1. ANSI A 21.50/AWWA C150
 - 2. ANSI A-21.51/AWWA C151
 - 3. ANSI A-21.41/AWWA C104
- C. Factory Tests: The manufacturer shall perform the factory tests described in ANSI A-21.51/AWWA C151.
- D. Quality Control
 - 1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards. All pipe on this Project shall be supplied by a single manufacturer unless otherwise accepted in writing by the OWNER.
 - 2. In addition to the manufacturer's quality control procedures, the OWNER may select an independent testing laboratory to inspect the material at the foundry for compliance with these specifications. The cost of foundry inspection requested by the OWNER will be paid for by the OWNER.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Submit Shop Drawings and piping layouts, including areas within and under buildings and structures. Shop Drawings shall include dimensioning, methods and locations of supports and all other pertinent technical specifications. Show locations of all field cuts. Shop Drawings shall be prepared by the pipe manufacturer. Shop Drawings for piping within and under buildings and structures shall be submitted within 30-days of Execution of Contract.

B. Operating Instructions: Submit Operation and Maintenance Manuals in accordance with Section 01001 "General Work Requirements."

C. Manufacturer's Certification

1. Submit manufacturer's sworn certification of factory tests and test results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

The Contractor shall be responsible for all materials furnished and stored until the date of project completion. The Contractor shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the OWNER, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. Stored pipe shall be covered for protection against contamination and UV light. Joint gaskets shall be stored in clean, dark and dry location until immediately before use.

B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe and fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of the OWNER or be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner which will not permit distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the OWNER, is damaged beyond repair by the Contractor shall be removed from the site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ductile Iron Pipe

1. Standards: ANSI A-21.50, AWWA C150 and ANSI A-21.51, AWWA C151
2. Thickness/Pressure Class:
 - a. Below ground piping: Class 350 (4-inch to 12-inch), Class 250 (16-inch to 24-inch) and Class 200 (30-inch to 64-inch) unless otherwise noted or specified.
 - b. Above ground piping: Flanged, Class 350 (minimum) unless otherwise noted or specified.
3. Joints
 - a. Push-on or Mechanical Joints (below ground piping) (Non vacuum rated)
 - (1) Standards: ANSI A21.11, AWWA C111
 - (2) Class: 350-psi working pressure rating
 - (3) Gaskets
 - (a) Potable and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) ring type.
 - (b) Wastewater Service: Neoprene rubber ring type.
 - b. Flanged (above ground or inside below ground vaults)
 - (1) Standards: ANSI A21.15, ANSI B16.1
 - (2) Class: 125-pound factory applied screwed long hub flanges, plain faced without projection.
 - (3) Gaskets
 - (a) Spans less than 10-feet: full-face 1/8-inch thick neoprene rubber
 - (b) Spans greater than 10-feet: Toruseal gaskets as manufactured by American Cast Iron Pipe or acceptable equal.
 - c. Restrained Joints (Non vacuum rated)
 - (1) Manufacturers: Lok-Ring system (all sizes) or locking type gasket systems (for 16-inch diameter and smaller) as manufactured by American Ductile Iron Pipe; MEGALUG System as manufactured by EBBA Iron; or acceptable equal.
 - (2) Class: 250-psi minimum design pressure rating.
 - (3) Standard mechanical joint retainer glands shall not be acceptable.
 - d. Joint Accessories
 - (1) Mechanical joint bolts, washers and nuts: Ductile iron or Corten steel.
 - (2) Flanged joint bolts, washers and nuts: 316 stainless steel with bolts and nuts conforming to ASTM A193 Grade B8M.
 - e. Pipe Length (below ground installation): 20-feet maximum nominal length.
4. Pipe Identification
 - a. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe which is not clearly marked is subject to rejection. The Contractor shall remove all rejected pipe from the project site within five NORMAL WORKING DAYS.

B. Fittings

1. Ductile iron fittings 4-inch through 24-inch shall be pressure rated at 350-psi minimum, except flanged joint type fittings which shall be rated at 250-psi minimum. All 30-inch and larger fittings shall be pressure rated to 250-psi minimum. All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron only. All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline. All fittings shall be designed to be capable to withstand, without bursting, hydrostatic tests of three times the rated water working pressure. All fittings shall have a date code cast (not printed or labeled) with identification of date, factory, and the factory unit from which it was cast and machined. Fittings shall have the pressure rating, nominal diameter of openings, manufacturer's name, and the country where cast and number of degrees or fraction of the circle distinctly cast on them. Ductile iron fittings shall have the letter "DI" or "Ductile" cast on them.
2. Joints shall be as described for ductile iron pipe for above ground/exposed and buried service.
3. All potable water main fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.

2.02 COATINGS, LININGS AND IDENTIFICATION MARKINGS

A. Exterior Coatings

1. Below ground/buried or in a casing pipe:
 - a. Type: Asphaltic coating, 1.0-mil DFT in accordance with ANSI/AWWA A21.51/C151.
 - b. Markings: (continuous 3-inch wide strip within top 90 degrees of pipe - min. drying time 30-minutes before backfill).
 - c. Color:
 - (1) Raw Wastewater: Safety Green
 - (2) Reclaimed Water: Purple (Pantone 522C)
 - (3) Potable Water: Safety Blue
2. Above ground/Exposed/In vaults
 - a. Coatings and coating testing for ductile iron pipe and fittings for above ground/exposed applications shall be accordance with Division 9. Primer, intermediate and final coats whether shop or field applied shall be compatible and applied in accordance with the coating system manufacturer's recommendations. Asphaltic seal coat applied to the exterior of above ground piping and fittings shall be blasted and completely removed prior to coating per NACE-3/SSPC-SP6 commercial blast cleaning minimum angular anchor profile of 1.5-mils.
 - b. Color
 - (1) Raw Wastewater: Safety Green
 - (2) Reclaimed Water: Purple (Pantone 522C)
 - (3) Potable Water: Safety Blue
3. Inside Wetwell
 - a. All piping inside of wastewater wetwell shall be 316 stainless steel.

B. Interior Lining (Applied by pipe manufacturer)

1. Wastewater: Interior coating shall be Protecto 401 (amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment) for all pipe and fittings. All ductile iron pipe and fittings shall be delivered to the manufacturer certified applicator without asphalt, cement lining, or any other lining on the interior surface and no coating shall have been applied to the first 6-inches of the exterior of the DIP spigot ends. Minimum surface preparation shall be SSPC-SP 1 Solvent Cleaning method to remove oil and grease followed by NACE-4 / SSPC-SP7 Brush-Off Blast Cleaning. Protecto 401 shall be applied within 12-hours of surface preparation to the interior of the pipe and fittings so as to obtain a continuous and relatively uniform and smooth integral lining with a total minimum dry film thickness of 40-mils for the complete system. No lining shall take place when the substrate or ambient temperature is below 40°F. The lining shall not be used on the face of the flange of fittings or flanged pipe. The system shall be holiday free and holiday testing (minimum 2000 volts) shall be conducted and pinholes shall be repaired prior to shipping.
2. Potable Water and Reclaimed Water: Interior coating shall be fusion-bonded epoxy (FBE) or Cement Mortar lined with asphaltic seal coat.
 - a. FBE for Fittings: Fittings shall be supplied with a FBE coating, both inside and outside for total protection including flanged and buried fittings. The exterior of flanged fittings for above ground assemblies shall adhere to final exterior coating requirements per 3119 2.04 A. The FBE coating system shall meet or exceed ANSI/AWWA C-550 and C116/A21.116 requirements and shall have NSF 61 certification. FBE coating thickness shall be 6 to 8-mils dry film thickness, shall be applied for secure adhesion, shall have a smooth surface and shall be holiday free.
 - b. Cement mortar lining with a seal coat of asphaltic material shall be in accordance with ANSI/AWWA A21.4/C104.

C. Polyethylene Encasement is required when pipe is within 10-feet of a gas main or as indicated on the Drawings:

1. Standard: ANSI A 21.5/AWWA C105, 8-mil minimum thickness.

2.03 LOCATION MARKERS AND LOCATION WIRE

A. Electronic Markers and Locator System (for reclaimed water and wastewater ONLY)

1. Markers: Markers shall consist of a passive device capable of reflecting a specifically designated repulse frequency tuned to the utility (service) being installed. Markers shall be color coded in accordance with American Public Works Association's "Utility Locating and Coordinating Council Standards." Colors shall be: Wastewater and Reclaimed Water - #1404 Green. Markers shall be full range. Markers shall be installed directly above the centerline of the respective pipeline at intervals not to exceed 100-feet, at each fitting (tees, wyes, crosses, reducers, plugs, caps and bends) or change in horizontal direction and at each valve along the pipeline. Markers shall be hand backfilled to 1-foot above the pad and have a finished depth of burial of not less than 2-feet or more than 6-feet. No separate payment shall be made for furnishing and installing the respective frequency and color-coded electronic pad type marker.
2. Locator System: Marker locator set shall be the Scotch Mark EM II Electronic Marker Locator Path Tracing Receiver, or acceptable equal. The Contractor shall furnish 1-locator set for each type of service piping installed on the project (i.e.: reclaimed water, wastewater) to the OWNER. Each unit shall incorporate the following features and accessories:
 - a. Unit(s) shall be tuned to the proper frequency for each type (service) of piping.
 - b. Field strength meter that provides visual indication of the return signal.
 - c. Function switch for selection of operation mode.
 - d. Sensitivity control to adjust the receiver gain.
 - e. Audio speaker for signal response.
 - f. Battery access panel containing condensed operating instructions.
 - g. Auxiliary headset and heads set jack.
 - h. Permanently attached shoulder straps.
 - i. Rugged shockproof and weatherproof storage/carrying case.
3. Manufacturer: System shall be Scotch Mark Locator System, or acceptable equal.

B. Location Detection Wire

1. Materials: Continuous, insulated 10-gauge copper wire (color to match pipe identification).
2. Installation: Directly above (1-inch maximum) centerline of pipe terminating at top of each valve box collar and be capable of extending 12-inches above top of box (stored inside the 2-inch brass pipe through the valve box collar) in a manner so as not to interfere with valve operation. For direction drilling installations, a minimum of 2 (two) 10-gauge wires shall be pulled along with the pipe.
3. Continuity: Continuity of wire to be tested using Metrotech 810/9860 or acceptable equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Ductile iron pipes shall be installed in accordance with AWWA C600 and AWWA Manual M-42. When a restraining type gasket is used, the bell shall be painted red.
- B. Underground Ductile Iron Pipe and Fittings.
 - 1. Bedding firm, dry and even bearing of suitable material. Blocking under the pipe will not be permitted.
 - 2. Placement
 - a. Alignment: In accordance with lines and grades shown on the Drawings. Deflection of joints shall not exceed 75% of the values recommended by the pipe manufacturer.
 - b. The Contractor shall provide line and grade stakes at a 100-foot maximum spacing and at all line and/or grade change locations. The Contractor shall provide temporary benchmarks at a maximum of 1,000-foot intervals. The minimum pipe cover shall be 30-inches below the finished grade surface or 30-inches below the elevation of the edge of pavement of the road surface whichever is greater.
 - c. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked greater than 1-inch shall result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.
 - d. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.
 - e. Trench Dewatering and Drainage Control: Contractor shall prevent water from entering trench during excavation and pipe-laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.
 - f. Pipe Laying in Trench: Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the OWNER to ensure absolute cleanliness inside the pipe. The pipe shall be installed with the color stripe and pipe text on the top of pipe.

3. Cutting: When required, cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of the pipe to be used with a push-on bell shall be beveled. Bare metal exposed at ends of the pipe shall be field coated in accordance with pipe manufacturer's recommendations. Cut pipe for wastewater service shall have exposed bare metal ends repaired with Protecto 401 using the coating system manufacturer's field repair kit.

4. Joints

- a. Joint Placement

- (1) Push on joints: Pipe shall be laid with the bell facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.
 - (2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

- C. Thrust Restraint

1. General: Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.
 2. Length of Restrained Joints: In accordance with the lengths listed in the table as shown on the Drawings or Standards..

- D. Installation of Pipes on Curves

1. Maximum deflections at pipe joints, fittings and laying radius for the various pipe lengths shall not exceed 75% (percent) of the pipe manufacturer's recommendation.

3.02 CLEANING AND FIELD TESTING

- A. General: At the conclusion of the Work, the Contractor shall provide all associated cleaning and field testing as specified in other related sections of these specifications.

END OF SECTION

SECTION 15064
POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install and test all polyvinyl chloride (PVC) piping, fittings and appurtenances as shown on the Drawings and specified herein.
- B. General Design: The equipment and materials specified herein are intended to be standard types of PVC pipe and ductile iron fittings for use in transporting wastewater, reclaimed water, and water.

1.02 QUALITY ASSURANCE

- A. Qualifications: All of the PVC pipe and ductile iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with these specifications as applicable.
- B. Standards:
 - 1. AWWA C900/C905
 - 2. ASTM D1784 / D1785 / D2241 / D2466 / D2564 / D2729 / D2774 / D3034 / D3139 / D3212
 - 3. NSF 14
 - 4. UNI-B-1 through 5
- C. Factory Tests: The manufacturer shall perform the factory tests described in Section 3 - AWWA C900/C905.
- D. Quality Control:
 - 1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards.
 - 2. In addition to the manufacturer's quality control procedures, the OWNER may select an independent testing laboratory to inspect the material at the production facility for compliance with these specifications. The OWNER will pay for the cost of facility inspection requested by the OWNER.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the OWNER/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Materials and Shop Drawings
- C. Manufacturer's Certification
 - 1. Submit sworn certification of factory tests and their results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. PVC pipe shall be covered with black plastic with a minimum thickness of 15-mil. Joint gaskets shall be stored in a clean, dark and dry location until use.
- B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe or fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of OWNER or it shall be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner to prevent distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the OWNER, is damaged beyond repair by the Contractor shall be removed from the site.
- C. The Contractor shall be responsible for all materials furnished and stored until the date of project completion. The Contractor shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the OWNER, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe
 - 1. Standards: AWWA C900/C905 and ASTM D1784/D3034/F679 (Gravity Sewer)
 - 2. Compounds: Class 12454-A or Class 12454-B
 - 3. PVC Gravity Pipe and Fittings: PVC gravity pipe (6-inch to 15-inch), shall conform to ASTM D3034, maximum SDR 35. PVC gravity pipe (18-inch to 36-inch), shall

- conform to ASTM F679 and uniform minimum "pipe stiffness" at 5% (percent) deflection shall be 46-psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI Bell Plastic Pipe Association standard is UNI B.
4. PVC Pressure Pipe and Fittings: All PVC pipe of nominal diameter 4 to 12-inches shall be manufactured in accordance with AWWA Standard C900 and greater than 12-inches shall be manufactured in accordance with AWWA Standard C905. The PVC pipe shall have a minimum working pressure rating of 100-psi and shall have a maximum dimension ratio of 18. Pipe shall be the same outside diameter as ductile iron pipe.
 5. PVC Vacuum Sewer Pipe and Fittings: All PVC pipe shall conform to Section 02730 - Underground Vacuum Sewer Piping
 6. Dimension Ratio/Thickness: (unless otherwise shown on the Drawings)
 - a. Raw Wastewater:
 - (1) Pressure Systems: DR 18
 - (2) Gravity Systems: SDR 26
 - b. Treated Wastewater: DR 18
 - c. Reclaimed Water: DR 18
 - d. Raw Water: DR 18
 - e. Potable Water: DR 18
 - f. Irrigation Piping: Schedule 40 or SDR 21
 7. Joints:
 - a. Push-on integral bell elastomeric gasket joints:
 - (1) Standards: ASTM D3212/D3139/F477 and UNI-B-1
 - (2) Gaskets:
 - (a) Potable and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) rieber type.
 - Wastewater Service: Styrene Butadiene Rubber (SBR) rieber type for C900 / C905 pipe. Styrene Butadiene Rubber (SBR) ring type for gravity systems.
 - (b)
 - (3) Pipe Markings: Pipes shall have a manufacturer's home-mark on the spigot. On field cut pipe, the Contractor shall provide home-mark on the spigot in accordance with manufacturer's recommendations.
 - b. Solvent weld (nominal diameter less than 4-inches):
 - (1) Standards: ASTM D2466/D2564
 - (2) Type: Slip Fitting Socket (tapered)
 - (3) Exclusions: Plastic saddle and flange joints will not be used.
 - c. Restrained Joints:
 - (1) Restrained joint devices shall be made specifically for PVC pipe and meet or exceed the requirements in ASTM F-1674.
 - (2) Manufacturers: Uni-flange mechanical joint restraints and bell restraints (for all sizes); Meg-a-lug system as manufactured by EBBA Iron (sizes 12-inches or less), or acceptable equal.
 - (3) Design pressure rating equal to or above test pressure as specified herein.
 - d. Pipe Length:
 - (1) Pressure systems: 20-feet maximum nominal length
 - (2) Gravity systems: 13-feet minimum nominal length

B. Fittings - Pressure Systems (nominal diameter 4-inches and greater):

1. Materials: Ductile iron
2. Joints: Mechanical Joint, Minimum 350-psi pressure rating
3. Gaskets:
 - a. Water and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) ring type
 - b. Wastewater Service: Neoprene rubber ring type
4. Exclusions: Standard double bell couplings will not be acceptable where the pipe will slip completely through the coupling.
5. All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron.
6. All fittings shall have a date code cast (not printed or labeled), with identification of the date, factory and unit at which it was cast and machined. Fittings shall have distinctly cast on them the pressure rating, nominal diameter of openings, manufacturer's name, the country where cast, and deflection angle. Ductile iron fittings shall have the letters "DI" or "Ductile" cast on them.
7. All potable water main fittings shall have NSF certification and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.
8. All ductile iron fittings shall have exterior coatings, including markings and colors, and interior linings in conformance with Section 15062 "Ductile Iron Pipe and Fittings."

C. Fittings - Pressure Systems (nominal diameter less than 4-inches)

1. Material: Polyvinyl Chloride (PVC)
2. Joints: Slip fitting tapered socket with solvent weld
3. Solvent: Sure Guard 12 or acceptable equal
4. Exclusions: Plastic saddle and flange joint fittings shall not be used

2.02 LOCATION MARKERS, LOCATION WIRE AND IDENTIFICATION MARKINGS

A. Electronic Markers and Locator System (for reclaimed water and wastewater ONLY)

1. Markers: Markers shall consist of a passive device capable of reflecting a specifically designated repulse frequency tuned to the utility (service) being installed. Markers shall be color coded in accordance with the American Public Works Association's "Utility Locating and Coordinating Council Standards." Colors shall be: Wastewater and Reclaimed Water - #1404 Green. Markers shall be full range. Markers shall be installed directly above the centerline of the respective pipeline at intervals not to exceed 100-feet, at each fitting (tees, wyes, crosses, reducers, plugs, caps and bends) or change in horizontal direction and at each valve along the pipeline. Markers shall be hand backfilled to 1-foot above the pad and have a finished depth of burial of not less than 2-feet or more than 6-feet. No separate payment shall be made for furnishing and installing the respective frequency and color-coded electronic pad type marker.
2. Locator System: Marker locator set shall be the 3M Dynatel 1420 or 3M Dynatel 1420E Electronic Marker System Marker Locator, or acceptable equal. The Contractor shall furnish 1 locator set for each type of service piping installed on the Project (i.e.: reclaimed water, wastewater.) to the OWNER. Each unit shall

incorporate the following features and accessories:

- a. Unit(s) shall be tuned to the proper frequency for each type (service) of piping.
 - b. Field strength meter that provides visual indication of the return signal
 - c. Function switch for selection of operation mode
 - d. Sensitivity control to adjust the receiver gain
 - e. Audio speaker for signal response
 - f. Battery access panel containing condensed operating instructions
 - g. Auxiliary headset and heads set jack
 - h. Permanently attached shoulder straps
 - i. Rugged shockproof and weatherproof storage/carrying case
3. Manufacturer: System shall be Scotch Mark Locator System, or acceptable equal.

B. Location Detection Wire

1. Materials: Continuous, insulated 10-gauge copper wire (color to match pipe identification).
2. Installation: Directly above (1-inch maximum) centerline of pipe terminating at top of each valve box collar and be capable of extending 18-inches above top of box (stored inside the 2-inch brass pipe through the valve box collar) in a manner so as not to interfere with valve operation. For direction drilling installations, a minimum of 2 (two) 10-gauge wires shall be pulled along with the pipe.

C. Identification Markings:

1. Pipe furnished in solid color or white with color lettering as indicated below.
 - a. Lettering along top 90° (degrees) of pipe, minimum 3/4-inch in height with appropriate wording appearing 1 or more times every 21-inches along the entire length of the pipeline.
 - (1) Raw Wastewater: Safety Green
 - (2) Reclaimed Water: Purple (Pantone 522C)
 - (3) Potable Water: Safety Blue

PART 3 - EXECUTION

3.01 INSTALLATION

A. Standards: AWWA C900/C905/UNI-B 3 and 4

B. Underground Polyvinyl Chloride (PVC) Pipe and Fittings

1. Bedding: Firm, dry and even bearing of suitable material. Blocking under the pipe will not be permitted.
2. Placement/Alignment:
 - a. Installation shall be in accordance with lines and grades shown on the Drawings. For pressure systems, deflection of joints shall not exceed 75% of that recommended by the manufacturer.
 - b. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked on pipe shall

result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

- c. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.
- d. Trench Dewatering and Drainage Control: Contractor shall prevent water from entering trench during excavation and pipe laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.
- e. Pipe Laying in Trench: Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the OWNER to ensure absolute cleanliness inside the pipe. The color stripe and pipe text shall be viewed from the top of pipe when installed. When installing PVC pipe, no additional joints will be installed until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.
- f. Locating Wire: Locating wire, for electronically locating pipe after it is buried, or installed by trenchless technology shall be attached along the length of and installed with the pipe. This is applicable to all sizes and types of pressure mains. At a minimum, the tracing wire is to be attached to the pipe with nylon wire ties. The wire itself shall be 10-gauge single strand solid core copper wire with non-metallic insulation. The insulation shall be color coded for the type of pipe being installed. Continuous continuity must be maintained in the wire along the entire length of the pipe run. Permanent splices must be made in the length of the wire using wire connectors approved for underground applications as listed in the uniform electric code handbook. The coiled wire shall extend to a minimum of 12-inches above the surface and be connected to a test station box at valve locations.
- g. PVC Pressure Pipe Installation and Training: PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC Pipe", AWWA C605, and AWWA Manual M-23. The pipe shall be laid by inserting the spigot end into the bell flush with the insertion line or as recommended by the manufacturer. At no time shall the bell spigot end be allowed to go past the "insertion line" or "homing mark" for pressure pipe applications and homing mark shall be visible.

- h. Field Cutting: PVC pipe can be cut with a handsaw or power driven abrasive disc making a square cut. The end shall be beveled with a beveling tool, wood rasp or power sander to the same angle as provided on the factory-finished pipe. The insertion line on the spigot shall be remarked to the same dimensions as the factory-marked spigot.
- i. All Contractor pipe crews utilizing PVC pressure pipe shall be trained on an annual basis by Uni-Bell in coordination with the OWNER and attended by the manufacturer's representative. The Uni-Bell PVC training session will consist of proper handling, storage, installation, and compaction as well as OWNER requirements regarding PVC pipe and deflection. Every person handling, installing or backfilling PVC pipe shall not be permitted to install OWNER owned and / or maintained pipe without training.
- j. All Contractor pipe crews utilizing PVC pressure pipe solvent weld fittings shall be trained on an annual basis by Spears Mfg. in coordination with the OWNER and attended by the manufacturer's representative. The Spears training session will consist of proper handling, storage, installation, and solvent welding as well as OWNER requirements regarding fittings. Every person handling, installing or backfilling PVC fittings shall not be permitted to install OWNER owned and / or maintained pipe without training.
- k. Approved manufacturers representatives, not present at the hosted Uni-Bell training session or individuals of pipe crews not in attendance shall be trained on every project site. On-site project training shall be for each manufacturer of pipe utilized on-site, per crew and per project. Specifically each crewmember shall be trained on every project by every pipe manufactures representative regardless of previous on-site training. Every person handling, installing or backfilling PVC pipe shall not be permitted to install OWNER owned and / or maintained pipe without training.
- l. PVC Gravity Pipe Installation: Gravity sewer pipe shall be installed to the homing mark, no tolerance. Any noticeable separation shall be removed and reinstalled. The homing mark may be disregarded to meet the maximum of 1-inch separation between bell and spigot requirement. Joints:
- m. Joint Placement:
 - (1) Push on joints: Pipe shall be laid with the bell ends facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.
 - (2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

C. Thrust Restraint

- 1. Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.
- 2. Length of restrained joints shall be in accordance with the lengths listed in the table as shown on the Drawings.

D. Installation of Pipes on Curves:

1. No joint deflection or pipe bending is allowed in PVC pipe. The maximum allowable tolerance in the joint due to variances in installation is 0.75° (degrees) (3-inches per joint per 20-foot stick of pipe). No bending tolerance in the pipe barrel shall be acceptable. Alignment change shall be made only with sleeves and fittings.

3.02 CLEANING AND FIELD TESTING

- A. At the conclusion of the Work, the Contractor shall provide all associated cleaning and field testing as specified in associated sections of these specifications.

END OF SECTION

SECTION 15111

GATE VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish and install gate valves of the type and size and in the locations as shown on the Drawings and/or specified herein.
- B. General Design
 - 1. Resilient seat non-rising stem (NRS) gates valves shall be used for underground service and for aboveground service where shown on the Drawings.
 - 2. Resilient seat Outside Stem and Yoke (OS&Y) gate valves shall be used for aboveground service only where shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. All gate valves of same type and style shall be manufactured by one (1) manufacturer.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the OWNER/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Shop Drawings and submittals shall be submitted to the OWNER/Professional Engineer for review and acceptance prior to construction for the following:
 - 1. Certified Shop Drawings showing details of construction, dimensions (including laying length), and weight.
 - 2. Descriptive literature, bulletins, and/or catalogs showing all valve parts and describing material of construction by material and specification, e.g., AISI.
 - 3. Valve coatings and linings, if any.
 - 4. A complete bill of materials for all equipment.
 - 5. See individual sections for additional requirements.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Shipping
 - 1. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed.
 - 2. Factory assembled parts and components shall be dismantled for shipment unless permission is received in writing from the OWNER/Professional Engineer.

3. Finished surfaces of all exposed openings shall be protected by wooden blanks, strongly built and securely bolted thereto.
4. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
5. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.
6. Each box or package shall be properly marked to show its net weight in addition to its contents.

B. Storage

1. Store valves and accessories in an area on the construction site protected from weather, moisture, or possible damage.
2. Do not store valves or accessories directly on the ground.

C. Handling

1. Handle valves and accessories to prevent damage of any nature.
2. Carefully inspect all materials for:
 - a. Defects in workmanship and materials.
 - b. Removal of debris and foreign material in valve openings and seats.
 - c. Proper functioning of all operating mechanisms.
 - d. Tightness of all nuts and bolts.

1.05 WARRANTY AND GUARANTEES

- A. The manufacturer's warranty period shall be concurrent with the Contractor's for 1-year, unless otherwise specified, commencing at the time of final acceptance by the OWNER.
- B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all equipment which lists for more than \$500.00 (major equipment). The OWNER reserves the right to request warranties for equipment not classified as "major". The Contractor shall still warrant equipment not considered to be "major" in the Contractor's 1-year warranty period even though certificates of warranty may not be required.
- C. In the event that the equipment manufacturer or supplier is unwilling to provide a 1-year warranty commencing at the date of substantial completion, the Contractor shall obtain from the manufacturer a 2-year warranty commencing at the time of equipment delivery to the job site. This 2-year warranty from the manufacturer shall not relieve the Contractor of the 1-year warranty starting at the time of OWNER acceptance of the equipment.
- D. The OWNER shall incur no labor or equipment cost during the guarantee period.
- E. Guarantee shall cover all necessary labor, equipment, and replacement parts resulting from faulty or inadequate design, improper assembly or erection, defective workmanship and materials, leakage, breakage, or other failure of equipment or components furnished by the manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Gate valves shall be resilient seat gate valves, manufactured to meet or exceed the requirements of AWWA C509/C515, latest revision, and these Specifications. All valves are to be tested in strict accordance with AWWA C509/C515.
- B. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.
- C. The minimum design working water pressure shall be minimum 250-psig.
- D. Gate valves shall be installed vertically per the Drawings and with minimum depth of cover per Table 15111-1.

Table 15111-1
Minimum Pipe Cover Required for Valves

Pipe Diameter (Inches)	Vertical Gate Valve Cover	
	LOCAL Roadway	Non-LOCAL Roadway*
4-inch – 8-inch	30-inch	36-inch
12-inch	36-inch	36-inch
16-inch	44-inch	48-inch
20-inch	-	50-inch
24-inch	-	54-inch
* Additional 12-inches of cover is required for all vertical valves 16-inches and greater located in the pavement		

- E. Valves 16-inches and larger shall be AWWA C515 resilient seated only (16-inches through 24-inches no gearing required).
- F. The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B for C509 valves and ductile iron ASTM A536 for C515 valves. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating in accordance with AWWA C 550.
- G. A 2-inch wrench nut shall be provided for operating the valve. Valves 30-inches and larger shall be provide with spur gear actuators. Side actuated gate valves are not acceptable. All valves shall open left or counter clockwise.
- H. The valves shall have non-rising stems with the stem made of cast, forged, or rolled bronze as specified in AWWA C509. Two (2) stem seals shall be provided and shall be of the O-ring type. The stem nut must be independent of the gate.
- I. The resilient sealing mechanism shall provide zero leakage at test and normal working pressure when installed with the flow from either direction.
- J. Tapping valves shall be placed vertical where possible for Water and Reclaimed Water. When tapping existing mains, valves 24-inches and above shall be furnished with NPT

pipe plugs for flushing the tracks.

- K. All material supplied shall be one of the products specified in "Qualified Products List" appended to these technical specifications

PART 3 - EXECUTION

3.01 PREPARATION

- A. All valves shall be inspected upon delivery in the field to insure proper working order before installation. Valves shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connection ends furnished. All buried gate valves shall be connected using restrained joints. All valves and appurtenances shall be installed true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the OWNER before installation.

3.02 INSTALLATION

- A. Install valves and accessories in strict accordance with manufacturer's instruction and recommendations as shown on the Drawings and as directed by the OWNER.
- B. Carefully erect all valves and support them in their respective positions free from distortion and strain.
- C. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
- D. Support all valves connected to pumps and equipment and in piping systems that cannot support valves.
- E. Repair any scratches, marks and other types of surface damage with original coating as supplied by the factory.
- F. Valves shall be carefully inspected, opened wide and then tightly closed and the nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Any valve that does not operate correctly shall be removed and replaced.

3.03 INSPECTION AND TESTING

- A. Check and adjust all valves and accessories for smooth operation.
- B. Test valves for leakage at the same time that connecting pipelines are tested. See Section

appropriate section for pressure testing requirements. Protect or isolate any parts of valves, operators, or control and instrument systems whose pressure rating is less than the pressure tests.

END OF SECTION

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SECTION 15112

BUTTERFLY VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish and install butterfly valves of the type and size and in the locations as shown on the Drawings and/or specified herein.
- B. General Design
 - 1. All shut-off valves on potable water mains or reclaimed water mains 16-inch (406-mm) and larger shall be butterfly valves unless otherwise specified.
 - 2. Butterfly valves shall be fully operational and disc shall not interfere with adjacent piping/fittings.

1.02 QUALITY ASSURANCE

- A. All butterfly valves of the same type and style shall be manufactured by one manufacturer.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
 - 1. Certified Shop Drawings showing details of construction, dimensions (including laying length), and weight.
 - 2. Descriptive literature, bulletins, and/or catalogs showing all valve parts and describing material of construction by material and specification, e.g., AISI.
 - 3. An affidavit of compliance signed by the actuator manufacturer shall be required stating the provisions of ANSI/AWWA C504 have been met.
 - 4. Valve coatings and linings, if any.
 - 5. A complete bill of materials for all equipment.
 - 6. See individual sections for additional requirements.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Shipping
 - 1. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed.
 - 2. Factory assembled parts and components shall be dismantled for shipment unless permission is received in writing from the County/Professional.
 - 3. Finished surfaces of all exposed openings shall be protected by wooden blanks, strongly built, and securely bolted thereto.

4. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
5. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.
6. Each box or package shall be properly marked to show its net weight in addition to its contents.

B. Storage

1. Store valves and accessories in an area on the construction site protected from weather, moisture, or possible damage.
2. Do not store valves or accessories directly on the ground.

C. Handling

1. Handle valves and accessories to prevent damage of any nature.
2. Carefully inspect all materials for:
 - a. Defects in workmanship and materials
 - b. Removal of debris and foreign material in valve openings and seats
 - c. Proper functioning of all operating mechanisms
 - d. Tightness of all nuts and bolts

1.05 WARRANTY AND GUARANTEES

- A. The manufacturer's warranty period shall be concurrent with the Contractor's for 1-year, unless otherwise specified, commencing at the time of final acceptance by the County.
- B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all equipment which lists for more than \$500.00 (major equipment). The County reserves the right to request warranties for equipment not classified as "major". The Contractor shall still warrant equipment not considered to be "major" in the Contractor's 1-year warranty period even though certificates of warranty may not be required.
- C. In the event that the equipment manufacturer or supplier is unwilling to provide a 1-year warranty commencing at the date of substantial completion, the Contractor shall obtain from the manufacturer a 2-year warranty commencing at the time of equipment delivery to the job site. This 2-year warranty from the manufacturer shall not relieve the Contractor of the 1-year warranty starting at the time of County acceptance of the equipment.
- D. The County shall incur no labor or equipment cost during the guarantee period.
- E. Guarantee shall cover all necessary labor, equipment, and replacement parts resulting from faulty or inadequate design, improper assembly or erection, defective workmanship and materials, leakage, breakage, or other failure of equipment or components furnished by the manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MATERIALS

- A. Butterfly valves and operators shall conform to AWWA C504, latest version, and these Specifications.
- B. Valves shall be Class 150, minimum working pressure of 150-psi (1.034 MPa).
- C. The valve body shall be constructed of close grain cast iron per ASTM A126, Class B or equivalent material. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating in accordance with AWWA C550. All retaining segments and adjusting services shall be of corrosion resistant material.
- D. Valves shall have the manufacture's name and valve rating cast in the body.
- E. Valve seats shall be ethylene propylene diene monomer (EPDM) and shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material. Valve seats shall be designed to be leak-tight in both directions at differential pressures up to the rated pressure of the valve class.
- F. Valve disc shall be designed to withstand full differential pressures across the closed valve disc without exceeding a stress level equivalent to 1/5th of the tensile strength of the material.
- G. Valve shaft shall be turned, ground, and polished and shall be constructed of 18-8 stainless steel designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic seating torque. Shaft shall be of either a one-piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design.
- H. Valve actuators shall be designed for input torques based on a 150-psi valve pressure and a 16-foot/second velocity with a maximum input of 80-foot-pound on 2-inch nuts and shall withstand 250-foot-pounds. Valve actuators shall conform to the requirements of AWWA C504.
- I. All valve and actuators shall be installed, adjusted, and tested as an assembly by the valve manufacturer at the manufacturing plant. An affidavit of compliance signed by the actuator manufacturer shall be required stating the provisions of ANSI/AWWA C504 have been met. The rated torque capability of each actuator shall be sufficient to seat, unseat, and rigidly hold, in any intermediate position, the valve disc it controls.
- J. All valves shall open left or counter-clockwise and a ground level position indicator and extension stem/shaft for the 2-inch nut shall be provided for buried valves.
- K. All materials shall be in accordance with the Appendix D "List of Approved Products" as appended to these Specifications.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All valves shall be inspected upon delivery in the field to insure proper working order before installation. Valves shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connection ends furnished. All buried valves shall be connected using restrained joints. All valves and appurtenances shall be installed true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the County before installation.

3.02 INSTALLATION

- A. Install valves and accessories in strict accordance with manufacturer's instruction and recommendations as shown on the Drawings and as directed by the County.
- B. Carefully erect all valves and support them in their respective positions free from distortion and strain.
- C. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. Joints shall be watertight.
- D. Support all valves connected to pumps and equipment and in piping systems that cannot support valves.
- E. Repair any scratches, marks and other types of surface damage with original coating as supplied by the factory.
- F. Valves shall be carefully inspected, opened wide, and then tightly closed and the nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Any valve that does not operate correctly shall be removed and replaced.

3.03 INSPECTION AND TESTING

- A. Check and adjust all valves and accessories for smooth operation.
- B. Test valves for leakage at the same time that connecting pipelines are tested. See Section 02660 "Potable Water Distribution Piping" for pressure testing requirements. Protect or isolate any parts of valves, operators, or control and instrument systems whose pressure rating is less than the pressure tests.

END OF SECTION

SECTION 15135

METERS AND GAUGES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Specification sections apply to work of this section. See other Specification sections for requirements of other pressure gauges.

1.02 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of meters and gauges, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

PART 2 - PRODUCTS

2.01 PRESSURE GAUGES

- A. Gauges shall be of the March Mastergauge Series, or equal, with recalibrator for adjusting. Gauges shall be new and accurate within one-half of one percent throughout the entire scale range. The gauges shall be fitted with an adjustable red pointer. Gauges shall have 6-inch dial sizes and ranges of 0-120 psi for the pressure gauge.

2.02 OTHER PRESSURE GAUGES

- A. Pressure gauges not specified elsewhere shall have a 3-1/2 inch diameter face (minimum) and have a range from 0 - 120 psi unless otherwise selected or approved by Engineer. The gauges shall be Ashcroft Model #1009A complete with Ashcroft Model #100 ES diaphragm seal with glycerin, or equal. Case shall be stainless steel or aluminum with glass or phenolic plastic lens. Scale shall be white coated aluminum with permanently etched markings, and gradations shall be in both psi and feet.

PART 3 - EXECUTION

3.01 GENERAL

- A. The gauges and meter shall be installed in accordance with manufacturer's recommendations.

SECTION 15135 METERS AND GAUGES

B. All gauges shall be equipped with a T-handle cock, blow-off tee, snubber, and mineral oil filled gauge guard. The connector shall be brass with 1/4" male NPT.

3.02 INSPECTION

- A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.03 INSTALLATION OF PRESSURE GAUGES

- A. Install pressure gauges located on pipe at most readable position.

3.04 ADJUSTING AND CLEANING

- A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.
- B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows; repair any scratched or marred surfaces.

END OF SECTION

SECTION 15140

SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Specification sections, apply to work of this Section.
- B. Basic Materials and Methods Sections apply to work of this Section.

1.02 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Hangers located in areas of high humidity shall be copper, cadmium, molybdenum, or galvanized plated to provide a rust-free surface. Hangers shall be clean carbon steel free from rust, wiped prior to painting. Rusted hangers and rods shall be replaced. Where more than two pipes run parallel, pipes may be supported on trapeze hangers.
- B. All pipe supports shall have cast-iron saddles with steel anchors and nuts. Riser pipe shall be of steel with an iron floor flange. Flanges shall be firmly bolted to the floor. All pipe supports shall meet Federal Specifications WW-H-171C (38). All pipe supports shall be Grinnell 259 as manufactured by the Grinnell Co., Providence RI, or equal.
- C. All concrete embedded anchors shall be Type 304 Stainless Steel.

PART 3 – EXECUTION

3.01 HANGER SPACING SCHEDULE

<u>Pipe Sizes</u>	<u>Maximum Span-Feet</u>
1/2 and 3/4	6
1, 1/4	8
1, 1-1/2, 2	10
3, 3-1/3, 4	12
5, 6	16
8, 10	20
12, 14, 16	20

END OF SECTION

SECTION 15140 SUPPORTS AND ANCHORS

SECTION 15400 – PLUMBING

PART 1 - GENERAL

1.1 SCOPE

The work under this Contract consists of, but is not limited to, all the tasks to supply and install all the plumbing fixtures and ancillary items to produce a complete installation that is fully operational and capable of providing the service for which it was intended.

1.2 SUBMITTALS

- A. Submit manufacturers product data and shop drawings for approval. See section 1300.
- B. Submit record drawings in accord with sections 1720.

PART 2 - PRODUCTS

2.1 PIPING

- A. All water service piping shall be copper when above the floor and P. V. C. under the ground, of Schedule 40 or Schedule 80 as required to comply with the Florida Building Code and as recommended by the manufacturer of the fixtures for their proper operation and to suit the fittings.
- B. All exposed piping shall be brass, chromium plated.
- C. In no case shall a pipe be of less inside diameter than the inside diameter at the point of connection to the fitting it serves.
- D. See plans for pipe sizes.
- E. Not more than one lavatory, sink or similar fixture shall be supplied by a branch. Linear dimension not to exceed ten (10) feet.
- F. Pipes must be sleeved through walls and floors with PVC.
- G. Provide the necessary water hammer arresters and backflow preventers in accordance with the best trade practice, the Florida Building Code, and other regulatory agencies having jurisdiction.

2.2 VALVES

- A. Valves, 2-inch and smaller, shall be all bronze with screw ends (sweat type ends for copper).
- B. All valves must have a minimum working pressure of 125 p.s.i. steam.
- C. The valves shall have the manufacturer's name and valve rating cast in the body.
- D. The acceptable valve manufacturers are: Crane, Powell, Jenkins, Walworth, Lukenheimer, and Stockham.
- E. Provide valves equal to following Crane figure numbers.

2 Inches & Smaller 2 Inches & Smaller

Threaded

Soldered

Gate Figure 438

Gate Figure 1324

Globe Figure 7TF

Globe Class 125

Check Figure 1707

Check Figure 1707S

2.3 FITTINGS

- A. Threaded steel pipe: Malleable iron, 150 lb. banded, galvanized.
- B. Copper pipe water services: Wrought copper, solder-joint type, 95-5 solder.
- C. Unions: Provide either copper, galvanized malleable iron or brass ground joint unions for piping 2 inches in diameter or smaller.
- D. For PVC pipe use compatible molded preformed fittings and the manufacturer approved solvent.
- E. For Copper tube, drainage type, use wrought copper, solder joint, 95-5 solder.

2.4 MISCELLANEOUS

- A. Valve boxes: Precast, by Brooks Company or approved equal.
- B. Escutcheons: Chrome plated brass, with set screw, spring or other device to hold them securely in place. Provide for pipes passing through walls, floors and roof in all finished rooms.
- C. Hangers: Malleable or wrought iron split ring with adjuster.
 - 1. For steel or cast iron: Grinnell No. 115, Fee & Mason No. 215 or F & S No. 42.
 - 2. For copper: Grinnell No. 115C, Fee & Mason No. 215C or F & S NO. 42 CT.
- D. The exterior hose bibs shall be Quarter-Turn Wall Hydrant and Box, 5509QT, with vacuum breaker by Jay R. Smith Mfg. Co., www.jrsmith.com, or approved equal.
- E. The interior hose bibs shall be non-locking Quarter-Turn, with vacuum breaker
- F. Floor Drains: Zurn Model ZN-415 or approved equal with no-hub fittings and self cleaning traps. Trap each fixture separately unless otherwise specifically detailed.
- G. Furnish 4 lb. sheet lead flashing for all roof vents and drains.
- H. All fixture supports shall be steel plate with thru bolts.
- I. Cleanout Covers: Josam 58600-3 or approved equal.

2.5 FIXTURES

All fixtures and fittings shall be from the same manufacturer as indicated, or equal, approved by the County. Check plans for location of fixtures. Any fixtures shown in the plans must be supplied and installed by the Contractor.

- A. Janitor's Closet Sink - Kohler Bannon Service sink K-6716 or approved equal with rough

plate finish faucet K-8906 and K-6673 3" cast iron trap.

PART 3 - EXECUTION

- A. Run soil piping to point outside of building as indicated and connect to existing manhole if applicable.
- B. Install horizontal soil and waste piping to 1/8-inch per foot grade or as shown on plans. Run horizontal vent lines to minimum grade back to stacks and vertical vent lines as direct and free from bends as possible.
- C. Run piping above any ceiling as high as building construction permits, except where otherwise indicated in construction documents.
- D. Support horizontal soil pipe at (5') five foot intervals or less.
- E. Provide cleanouts at foot of each stack, at each change of direction of horizontal lines and in horizontal runs at 75 foot intervals.

END OF SECTION 15400

SECTION 15453

VACUUM STATION PUMPING AND ACCESSORY EQUIPMENT

PART 1 - GENERAL

The following specification is for the installation of all pre-fabricated Vacuum Collection and Pump Station. The mechanical and electrical equipment associated with the vacuum pump station skid shall be provided by the Owner through a separate contract with AIRVAC. Contractor shall install all equipment, and furnish and install all piping, valves, supports, anchors and all other associated appurtenances not provided by Owner for a complete and operational system.

1.01 DESCRIPTION OF WORK

- A. The extent of work under this section includes installing a pre-fabricated and factory tested complete and self-contained vacuum collection station mounted on a structural steel skid. The vacuum collection station equipment includes the vacuum tank, vacuum pumps, sewage pumps, associated piping and electrical panel and related instrumentation and appurtenances.
- B. The Contractor is responsible for furnishing and installing all piping, mechanical and electrical components, supports, anchors and all other related appurtenances necessary to place the pre-fabricated vacuum collection station in operation.
- C. The Contractor shall be responsible for unloading, storing, moving, setting, protecting and all other activities associated with the vacuum collection and pump station once the equipment is delivered to the Contractor's staging area.
- D. All electrical and mechanical equipment shall be properly stored by the Contractor to protect the equipment from the elements. Outside storage is not acceptable.

1.02 (NOT USED)

1.03 (NOT USED)

1.04 MANUFACTURER

- A. The manufacturer of the pre-fabricated station equipment and controls is AIRVAC as predetermined by the OWNER.

1.05 SUBMITTALS

- A. **SHOP DRAWINGS AND LITERATURE:** AIRVAC will provide a submittal including complete plan and elevation view drawings of assembled unit(s), vacuum tank and structural steel base. AIRVAC will also provide manufacturer's literature on all equipment provided with the station. Contractor shall provide shop drawings and literature for all other equipment and materials indicating materials of construction, physical properties, controls, operational requirements,

SECTION 15453 VACUUM STATION PUMPING AND ACCESSORY EQUIPMENT

details and other data not provide by AIRVAC.

1.06 OPERATION AND MAINTENANCE MANUALS

- A. O & M Manuals for all components of the vacuum pump station including recommended spare parts, start-up data and maintenance procedures will be provided by AIRVAC.
- B. Contractor shall provide O & M Manuals for all other mechanical and electrical equipment not provided by AIRVAC.

1.07 WARRANTY

- A. AIRVAC will provide a one-year manufacturer's warranty covering all materials and workmanship of products supplied by AIRVAC. Warranty shall commence from the date of station start-up and acceptance.
- B. Contractor shall provide a one-year warranty for all materials and workmanship provided by the Contractor. The warranty shall commence upon substantial completion of the project.

1.08 QUALITY CONTROL

- A. The Contractor is fully responsible for the proper installation of the pre-fabricated vacuum pump station, and shall install the system in strict accordance with AIRVAC's written recommendations. Any damage incurred to the equipment provided by the Owner shall be repaired by Contractor at no additional cost to the Owner.
- B. All equipment and necessary mechanical and electrical connections shall be installed in the presence of an AIRVAC representative.
- C. The Contractor shall schedule his activities accordingly to accommodate the delivery, installation and testing of the AIRVAC equipment and materials. No additional payment will be provided for coordination efforts or schedule delays.

PART 2 - EXECUTION

2.01 INSPECTION

- A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to AIRVAC and the Engineer.

2.02 CONTRACTOR RESPONSIBILITIES

SECTION 15453 VACUUM STATION PUMPING AND ACCESSORY EQUIPMENT

- A. Refer to AIRVAC's description of the equipment package or scope of supply letter provided in the bid package.

2.03 INSTALLATION OF TEMPORARY SKID UNIT

- A. General: Install skid unit where indicated, in accordance with manufacturers published installation instructions, complying with recognized industry practices to ensure that skid unit comply with requirements and serve intended purposes.
- B. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturers wiring diagram submittal to electrical installer.
- C. Verify that electrical wiring installation is in accordance with the manufacturer's submittal and installation requirements sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- D. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated.
- E. Piping shall be adequately supported to prevent sagging and vibration and to permit expansion, venting and drainage. Supports shall be situated to prevent the weight of piping and valves from bearing on the pumps.
- F. At the provided anchoring brackets/mounts/stake pockets on the Airvac equipment Drill and epoxy - 3/4" All thread min. embedment of 6" With Simpson Strong-tie Set XP.
Sewage and tank pump skid - 6 anchor points

The vacuum pump skid and control panel roll off skid shall be set level on the ground. Concrete block piers may be required to establish level at no additional cost to the owner.

2.04 INSTALLATION OF PERMANENT SKID UNIT

- A. General: Install skid unit where indicated, in accordance with manufacturers published installation instructions, complying with recognized industry practices to ensure that skid unit comply with requirements and serve intended purposes.
- B. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturers wiring diagram submittal to electrical installer.
- C. Verify that electrical wiring installation is in accordance with the manufacturer's submittal and installation requirements. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

SECTION 15453 VACUUM STATION PUMPING AND ACCESSORY EQUIPMENT

- G. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated.
- H. Piping shall be adequately supported to prevent sagging and vibration and to permit expansion, venting and drainage. Supports shall be situated to prevent the weight of piping and valves from bearing on the pumps.
- I. At the provided anchoring brackets/mounts on the equipment Airvac equipment
Drill and epoxy - ½" SS All thread min. embedment of 5" With Simpson Strong-tie Set XP. Use leveling nuts with Sika 212 non-shrink grout.
Sewage pump skid - 6 anchor points
Sewage Tanks - 2 saddles with 2 holes each saddles

The vacuum pump skid shall be mounted directly to the I-Beams beneath the floor grating. At no additional cost to the owner the engineer will design an acceptable anchoring method after the skid is set in place prior to start-up. For bidding the contractor can assume the vacuum pump skid will have 6 anchor points' and will require the use of ½" SS All thread strut tied between the skid anchor points and a 4" painted carbon steel angle beam with a length spanned across as many supporting member's via a clamp configuration.

2.04 ADJUSTING AND CLEANING

- A. Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.
- B. Start-up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturers touch-up paint.

2.05 START-UP OPERATIONS

- A. The contractor shall provide equipment testing and start-up services for the project.
- B. The Contractor shall be responsible for coordinating factory trained representatives for the testing and start-up of equipment requiring factory assistance during start-up.
- C. The Contractor shall functionally test the major equipment and electrical components to verify their compliance with manufacturers recommended specifications and contract documents.

D. The Contractor shall document site testing activities by written test procedures

SECTION 15453 VACUUM STATION PUMPING AND ACCESSORY EQUIPMENT

and a testing log shall be maintained at the project site.

- E. The Contractor shall coordinate with Airvac, Data Flow Systems, and CCU to assist with testing and start-up activities and provide the necessary training of CCU personnel in the operation and maintenance of the system.
- F. Start-up operations and testing shall be conducted prior to final acceptance and release of sewer flows to the station. Contractor shall coordinate specific start-up plan.

2.05A GENERAL START-UP REQUIREMENTS AND INSTRUCTIONS

Start-up Requirements – AIRVAC ITEMS

Below are the items that must be completed prior to scheduling the start-up with the AIRVAC Service Manager. If the items below are not completed upon arrival, AIRVAC reserves the right to invoice for additional trips and time that may be required to complete the start-up functions. Contact the AIRVAC Service Manager at (574) 223-3980 ext. 3916 for scheduling the start-up. A two-three week lead time is required for scheduling purposes.

- 1. Station equipment fully installed.
- 2. Line power supplied to the AIRVAC equipment.
- 3. A complete and operative force main that has been fully tested and ready to discharge water.
- 4. Passing 4-hour vacuum test at 22" Hg with less than 1" loss for both the vacuum station and vacuum collection lines.
- 5. Means to add 4000+ gallons of water to the vacuum collection tank for testing.
- 6. Vacuum and force main gauges installed.
- 7. Availability of the personnel required to witness the start-up to make official.
- 8. Means to add 2500+ gallons of water to flush the vacuum main and branch lines. Water quantity will vary with the size and number of vacuum lines.

2.05 B GENERAL VACUUM STATION START-UP INSTRUCTIONS

Vacuum Pumps

MOTOR ROTATION:

SECTION 15453 VACUUM STATION PUMPING AND ACCESSORY EQUIPMENT

Check the motor rotation at the cooling fan end of the vacuum pump motor. Turn the desired vacuum pump control switch on and off quickly and watch for motor rotation. The motor/fan should rotate counterclockwise when facing the fan end of the motor. If the rotation is not correct, turn off the power and switch two of the three motor power leads coming out of the bottom of the starter. Turn power back on and repeat above procedure to verify motor rotation is correct. Repeat procedure for all vacuum pumps.

FULL LOAD AMP RATING PER PHASE:

To check the vacuum pump motor operating amperage, operate the vacuum pump (preferably between 0" and 20" Hg.) and place an amperage meter on each of the three motor power leads at the bottom of the appropriate starter. Record the amperage reading with the leg to the left being phase 1, center leg is phase 2, and the leg to the right is phase 3. Repeat this procedure for each of the vacuum pumps and document the reading along with the vacuum level taken from the vacuum gauge on the collection tank in the appropriate spaces on the vacuum pump checklist.

VOLTAGE AT STARTER:

To check the vacuum pump motor operating voltage, operate the vacuum pump (preferably between 0" and 20" Hg.) and place the probes from a voltage meter on the wiring lugs at the bottom of the appropriate starter. The left and center lugs will be phase 1, the left and right lugs will be phase 2, and the center and right legs will be phase 3. Repeat this procedure for each of the vacuum pumps and document the reading along with the vacuum level taken from the vacuum gauge on the collection tank in the appropriate spaces on the vacuum pump checklist.

TIME REQ'D TO PUMP FROM 0" Hg TO 20" Hg:

Utilizing a stopwatch, record the time it takes for each pump to go from 0" to 20" Hg. The isolation valves for the incoming collection lines should be closed and the liquid level in the collection tank should be at the pumps off level

LOCATION OF TEST:

Where the tests are taken (e.g. fab shop, site).

Sewage Pumps

MOTOR ROTATION:

Check the motor rotation at the coupling between the motor and the pump. Turn the desired sewage pump control switch on and off quickly and watch for motor rotation. The motor should rotate in the direction indicated by the arrows on the sewage pump volute housing. If the rotation is not correct, turn off the power and switch two of the three motor power leads coming out of the bottom of the starter. Turn the power back on and repeat the above procedure to verify motor rotation is correct. Repeat procedure for both sewage pumps.

PUMP & DRIVER SECURELY BOLTED:

Check pump and motor to insure they are securely bolted to the decking.

COUPLING PROPERLY ALIGNED:

Check the coupling between the motor and the pump to verify that the coupling halves are aligned and the insert is properly positioned.

PIPING COMPLETE:

SECTION 15453 VACUUM STATION PUMPING AND ACCESSORY EQUIPMENT

Check all of the piping associated with the discharge from the sewage pumps along with the equalizing lines to verify all piping is in place and securely fastened together.

PUMP SHAFT TURNS FREELY:

With the power turned off, rotate the pump by hand at the coupling to verify it turns freely.

DISCHARGE VALVE CLOSED (DURING PRIMING):

Make sure the valves on the discharge side of the pumps are closed during priming of the pumps.

SUCTION VALVE OPEN:

Make sure the valves between the sewage pumps and the collection tank are open.

PUMP FULLY PRIMED:

Fill the collection tank with water until the level is above the top of the volute on the sewage pumps (approx. pump off level). Open the four 1" ball valves next to the collection tank on the sewage pump equalization lines. With the vacuum pumps turned off, open the 1" auxiliary ball valve next to the sight glass and drain all the vacuum from the collection tank. Slowly remove the plug from the top of each volute to bleed off any air that might be trapped in the volute. When only water comes out of the plug opening, replace the plug and tighten. The sewage pump is now fully primed.

PUMP & DRIVER PROPERLY LUBRICATED:

Pump and driver are lubricated at the factory and no additional lubrication is normally necessary.

FINAL COUPLING ALIGNMENT:

After the sewage pumps are operated for a short period of time, re-check the coupling between the pump and motor for proper alignment.

IMPELLER ADJUSTMENT:

Should there be a rubbing noise or the pump does not perform satisfactorily; an impeller adjustment may be necessary. Normally, impeller adjustments are made at the factory during testing and no additional adjustments are required in the field.

FULL LOAD AMP RATING PER PHASE:

To check the sewage pump motor operating amperage, operate the sewage pump (preferably with the vacuum level at 20" Hg.) and place an amperage meter on each of the three motor power leads at the bottom of the appropriate starter. Record the amperage reading with the leg to the left being phase 1, center leg is phase 2, and the leg to the right is phase 3. Repeat this procedure for both of the sewage pumps and document the reading along with the vacuum level taken from the vacuum gauge on the collection tank in the appropriate spaces on the sewage pump checklist.

VOLTAGE AT STARTER:

To check the sewage pump motor operating voltage, operate the sewage pump (preferably with the vacuum level at 20" Hg.) and place the probes from a voltage meter on the wiring lugs at the bottom of the appropriate starter. The left and center lugs will be phase 1, the left and right lugs will be phase 2, and the center and right legs will be phase 3. Repeat this procedure for both of the sewage pumps and document the reading along with the vacuum level taken from the vacuum gauge on the collection tank in the appropriate spaces on the

SECTION 15453 VACUUM STATION PUMPING AND ACCESSORY EQUIPMENT

sewage pump checklist.

DISCHARGE PRESSURE AT FORCE MAIN:

Observe and record the pressure reading on the compound pressure gauge installed on the common outgoing force main. Try to keep the vacuum level in the collection tank at the same level as when the electrical readings were taken.

TIME REQ'D TO PUMP FROM START POINT TO STOP POINT:

Utilizing a stopwatch, record the time it takes for each pump to go from the pump on to pump off level. Once again try to keep the vacuum level consistent with other activities.

LOCATION OF TEST:

Where the tests are taken (e.g. fab shop, site).

Station Vacuum Test

TEST #1:

Attach a 24-hour chart recorder to the collection tank. Appropriate fittings installed on the auxiliary 1" ball valve works well for an attachment point. Close the isolation valves on the

incoming collection lines and subject the collection tank and additional station interior pipe work to 22" Hg. and let the system stabilize for 15 minutes. Next record the vacuum loss for the next four hours. The loss should not exceed 1% per hour for the four-hour test 1".

TEST #2:

While the chart recorder is still attached to the collection tank, open the isolation valves to the collection system and subject the station equipment and the entire collection system to 22" Hg and let stabilize for 15 minutes. Once again, record the vacuum loss for the next four hours. The loss should not exceed 1% per hour for the four-hour test 1".

After the tests are completed, have all of the appropriate witnesses sign the passing chart and date it. Attach the charts to the start-up report and sign the system vacuum test page in the space provided.

Equipment information:

All equipment information (model no., serial no., electrical info, etc.) can be found on the tags and nameplates of the appropriate component.

PART 3 – TRAINING

3.01 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor is required to attend the onsite training to become familiar with the operation of the vacuum station equipment as it relates to the other equipment supplied by the Contractor. No separate payment will be made.

SECTION 15453 VACUUM STATION PUMPING AND ACCESSORY EQUIPMENT

END OF SECTION

SECTION 15453 VACUUM STATION PUMPING AND ACCESSORY EQUIPMENT

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following electrical materials and methods:
 - 1. Concrete equipment bases.
 - 2. Electrical demolition.
 - 3. Cutting and patching for electrical construction.
 - 4. Touchup painting.
 - 5. Meter sockets.

1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections.
- B. Product Data for each type of product specified.
- C. Shop Drawings detailing fabrication and installation of supports and anchorage for electrical items.
- D. Coordination Drawings for electrical installation.
 - 1. Prepare Coordination Drawings according to Section "Submittals" to a 1/4-inch-equals-1-foot (1:50) scale or larger. Detail major elements, components, and systems of electrical equipment and materials in relation to each other and to other systems, installations, and building components. Indicate locations and space requirements for installation, access, and working clearance. Show where sequence and coordination of installations is important to the efficient flow of the work. Coordinate drawing preparation with effort specified in other Specification Sections. Include the following:
 - a. Provisions for scheduling, sequencing, moving, and positioning equipment in the building during construction.

SECTION 16060 BASIC ELECTRICAL MATERIALS AND METHODS

- b. Floor plans, elevations, and details, including the following:
 - 1) Clearances to meet safety requirements and for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
 - 2) Sizes and locations of required concrete pads and bases.
- E. Samples of color, lettering style, and other graphic representation required for each identification product for Project.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70 for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.

1.05 SEQUENCING AND SCHEDULING

- A. Coordinate electrical equipment installation with other building components.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.
- C. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning prior to closing in the building.
- E. Coordinate connecting electrical service to components furnished under other Sections.
- F. Coordinate connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

PART 2 - PRODUCTS

2.01 CONCRETE EQUIPMENT BASES

- A. Forms and Reinforcing Materials: Forms and reinforcing materials shall be in conformance with the Contract Documents.

SECTION 16060 BASIC ELECTRICAL MATERIALS AND METHODS

- B. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Section "Cast-in-Place Concrete."

2.02 METER SOCKETS

- A. Meter sockets comply with serving utility company requirements.

2.03 TOUCHUP PAINT

- A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.
- B. For Non-equipment Surfaces: Matching type and color of undamaged, existing adjacent finish.
- C. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION REQUIREMENTS

- A. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated.
- B. Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated.
- C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Give right of way to raceways and piping systems installed at a required slope.

3.02 DEMOLITION

- A. Where electrical work to remain is damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work Indicated to Be Demolished: Remove exposed electrical installation in its entirety.

SECTION 16060 BASIC ELECTRICAL MATERIALS AND METHODS

- C. Abandoned Work: Cut and remove buried raceway and wiring indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap and patch surface to match existing finish.
- D. Removal: Remove demolished material from the Project site unless specifically noted to be turned over to the Owner.
- E. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.03 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair disturbed surfaces to match adjacent undisturbed surfaces.

3.04 TOUCHUP PAINTING

- A. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.
- B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3.05 ELECTRICAL POWER PANELS

- A. All electrical power panels shall be provided with locking mechanisms.

END OF SECTION

SECTION 16060 BASIC ELECTRICAL MATERIALS AND METHODS

SECTION 16090

SUPPORTING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Special Conditions and sections, apply to work specified in this section.
 - 1. National Electrical Contractors Association (NECA):
NECA - Standard of Installation.
 - 2. National Electrical Manufacturers Association (NEMA).

1.02 QUALITY ASSURANCE

- A. Reference Standards:

PART 2 - PRODUCTS

2.01 SUPPORTS

- A. Provide supporting devices of types, sizes and materials required:
 - 1. One Hole Conduit Straps: For supporting up to and including 3/4 inch rigid metal conduit; galvanized steel.
 - 2. Two Hole Conduit Straps: For supporting 3/4 inch and larger rigid metal conduit; galvanized steel.

2.02 ANCHORS

- A. Provide anchors of types, sizes and materials required:
 - 1. Lead Expansion Anchors: 1/2 inch; approximately 38 pounds per 100 units.
 - 2. Toggle Bolts: Springhead; 3/16 inch x 4 inch; approximately 5 pounds per 100 units.
 - 3. Manufacturers: Provide anchors of one of the following (for each type of anchor):
 - a. Ideal Industries, Inc.
 - b. Joslyn Manufacturing and Supply Company
 - c. Star Expansion Company
 - d. U.S. Expansion Bolt Company

SECTION 16090 SUPPORTING DEVICES

2.03 SLEEVES AND SEALS

- A. Provide sleeves and seals of types, sizes and materials indicated, with the following construction features:
 - 1. Wall and Floor Seals: Provide factory assembled water tight wall and floor seals, of types, and sizes required; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

2.04 U-CHANNEL STRUT SYSTEMS

- A. Provide U-channel strut system for supporting electrical equipment, 12 gauge hot dip galvanized steel, of types and sizes as required. Construct with 9/16 inch diameter holes, 8 inch o.c. on top surface, with standard green finish, and with fittings which mate and match with U-channel.
- B. Manufacturers:
 - 1. Provide U-channel strut systems of one of the following:
 - a. B-Line Systems, Inc.
 - b. Kindorf.
 - c. Power-Strut Division; Grinnell Corp.
 - d. Unistrut.

2.05 PIPE SLEEVES

- A. 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 sleeves from the following gauge metal:
 - a. 3 inch and smaller - 20 gauge.
 - b. 4 inch to 6 inch -16 gauge.
 - c. Over 6 inch - 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.
 - 4. Plastic Pipe: Fabricate from schedule 80 PVC plastic pipe; remove burrs.

2.06 SLEEVE SEALS

- A. Provide sleeves for piping which penetrates foundation walls below grade, or exterior walls. Caulk between sleeve and pipe with non-toxic, UL classified caulking material to ensure watertight seal.

SECTION 16090 SUPPORTING DEVICES

2.07 ALTERNATE SLEEVE SEALS

- A. Provide modular mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Install hangers, supports, and anchors only after structural work, where work is to be installed, has been completed. Correct inadequacies such as proper placement of inserts, anchors, and other building structural attachments.
- B. Examine areas and conditions under which equipment and associated components are to be installed and notify Engineer in writing, of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Determine that ceiling channel system is adequately supported to receive and support lighting fixtures. Where deemed inadequate, do not install fixtures until additional support is provided.

3.02 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install building attachments at required locations within concrete or on to structural steel or raceway and equipment support.
- B. Install additional building attachments where support is required for additional concentrated loads.
- C. Install concrete inserts before concrete is placed.

3.03 INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31 and to prevent the transfer of loading and stresses to connected equipment.
- B. Installation methods shall be in conformity with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of hole be less than four bolt diameters. Minimum distance between the center of any expansion anchor and an edge of exterior corner of concrete shall be not less than 4-1/2 times the diameter of the hole in which it is installed.

SECTION 16090 SUPPORTING DEVICES

3.04 SUPPORT OF CONDUIT

- A. Fasten conduit to structural parts of building in a manner acceptable to Engineer.
- B. Do not use perforated hanger iron or tie wire.
- C. Install concrete insert channel where required, and with spacings as designated by manufacturer of the equipment to be anchored. Install with anchor and caps, insert joiner clips and closer seals as required.
- D. Support conduit as follows:
 - 1. Single Conduit Runs:
 - a. Vertical Surfaces: Galvanized, heavy duty, sheet steel straps; back straps to be provided for all exposed conduit and conduit on exterior walls.
 - b. Horizontal Surfaces: Galvanized, heavy duty, 2-hole steel pipe straps.
 - 2. Multiple Conduit Runs:
 - a. Vertical Surfaces: Horizontal or vertical rack channel with conduit straps as required.
 - b. Horizontal Surfaces: Single or double rack channel trapeze, complete with conduit straps as required; all supported with threaded hanger rods.

3.05 FLOOR, WALL AND CEILING OPENINGS

- A. Pipe sleeves must be set for all pipes passing through new masonry construction. Coordinate with G.C. as to size and location of openings.
- B. Coordinate the location of sleeves, openings, chases, furred spaces, etc., with the other Contractors. Provide all sleeves, hangers and inserts that are to be built into the structure during the progress of construction.
- C. Pipe sleeves shall be Schedule 40 galvanized steel pipe and shall extend completely through the construction.
- D. Sleeves for pipe 4" and smaller shall be at least two pipe sizes larger than the pipe passing through.
- E. Sleeves shall extend 3/8" above the finished floor. In mechanical rooms and other areas where water may accumulate, sleeves shall extend 3" above the finished floor.
- F. Pack annular space between sleeves and insulation or pipe with fiberglass. Where penetrations occur through mechanical rooms or fire rated walls and floors, fill with Dow-Corning 3-6548 Silicone RTV Foam.

END OF SECTION

SECTION 16090 SUPPORTING DEVICES

SECTION 16120

WIRES AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes building wires and cables and associated splices, connectors, and terminations for wiring systems rated 600 volts and less.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section "Electrical Identification" for insulation color-coding and wire and cable markers.

1.03 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Specification Sections.
- B. Field test reports indicating and interpreting test results relative to compliance with performance requirements of testing standard.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70 "National Electrical Code" for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.

1.05 SEQUENCING AND SCHEDULING

- A. Coordination: Coordinate layout and installation of cable with other installations.

SECTION 16120 WIRES AND CABLES

1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Engineer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable according to NEMA WC-26.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Wires and Cables:
 - a. American Insulated Wire Corporation, Leviton Manufacturing Co.
 - b. Brand-Rex Cable Systems, Brintec Corp.
 - c. Carol Cable Company, Inc.
 - d. Senator Wire & Cable Co.
 - e. Southwire Co.
2. Connectors for Wires and Cables:
 - a. AFC, Monogram Co.
 - b. AMP, Inc.
 - c. Anderson, Square D Co.
 - d. Electrical Products Division, 3M Co.
 - e. O-Z/Gedney Unit, General Signal.

2.02 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Applications" Article.
- B. Rubber Insulation: Conform to NEMA WC 3.
- C. Thermoplastic Insulation: Conform to NEMA WC 5.
- D. Cross-Linked Polyethylene Insulation: Conform to NEMA WC 7.
- E. Ethylene Propylene Rubber Insulation: Conform to NEMA WC 8.
- F. Solid conductor for 10 AWG and smaller; stranded conductor for larger than 10 AWG.

SECTION 16120 WIRES AND CABLES

2.03 CONNECTORS AND SPLICES

- A. UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated. Select to comply with Project's installation requirements and as specified in Part 3 "Applications" Article.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. Service Entrance: Type XHHW, copper conductor, in raceway.
- B. Feeders: Type XHHW, copper conductor, in raceway.
- C. Branch Circuits: Type THHN/THWN, copper conductor, in raceway.
- D. Class 1 Control Circuits: Type THHN/THWN, copper conductor, in raceway.
- E. Class 2 Control Circuits: Type THHN/THWN, copper conductor, in raceway.

3.03 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and the NECA "Standard of Installation."
- B. Remove existing wire from raceway before pulling in new wire and cable.
- C. Pull conductors into raceway simultaneously where more than one is being installed in same raceway.
 - 1. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
 - 2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Conductor Splices: Keep to minimum.
 - 1. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
 - 2. Use splice and tap connectors that are compatible with conductor material.

SECTION 16120 WIRES AND CABLES

- E. Wiring at Outlets: Install with at least 12 inches (300 mm) of slack conductor at each outlet.
- F. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.04 FIELD QUALITY CONTROL

- A. Testing: Upon installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA Standard ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Correct malfunctioning products at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

END OF SECTION

SECTION 16130

RACEWAYS AND BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
 - 1. Raceways include the following:
 - a. RMC.
 - b. LFMC.
 - 2. Boxes, enclosures, and cabinets include the following:
 - a. Device boxes.
 - b. Outlet boxes.
 - c. Pull and junction boxes.
 - d. Cabinets and hinged-cover enclosures.
- B. Related Sections include the following:
 - 1. Section "Wiring Devices" for devices installed in boxes.

1.03 DEFINITIONS

- A. LFMC: Liquidtight flexible metal conduit.
- B. RMC: Rigid metal conduit.

1.04 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

SECTION 16130 RACEWAYS AND BOXES

1.05 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

- 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

- B. Comply with NECA's "Standard of Installation."

- C. Comply with NFPA 70.

1.06 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. Metal Conduit:

- a. Alflec Corp.
 - b. Anamet, Inc.; Anaconda Metal Hose.
 - c. Anixter Brothers, Inc.
 - d. Carol Cable Co., Inc.
 - e. Cole-Flex Corp.
 - f. Electri-Flex Co.
 - g. Flexcon, Inc.; Coleman Cable Systems, Inc.
 - h. Grinnell Co.; Allied Tube and Conduit Div.
 - i. Monogram Co.; AFC.
 - j. Spiraduct, Inc.
 - k. Triangle PWC, Inc.
 - l. Wheatland Tube Co.

- 2. Conduit Bodies and Fittings:

- a. American Electric; Construction Materials Group.
 - b. Crouse-Hinds; Div. of Cooper Industries.
 - c. Emerson Electric Co.; Appleton Electric Co.
 - d. Hubbell, Inc.; Killark Electric Manufacturing Co.
 - e. Lamson & Sessions; Carlon Electrical Products.
 - f. O-Z/Gedney; Unit of General Signal.
 - g. Scott Fetzer Co.; Adalet-PLM.

SECTION 16130 RACEWAYS AND BOXES

- h. Spring City Electrical Manufacturing Co.
- 3. Metal Wireways:
 - a. Hoffman Engineering Co.
 - b. Keystone/Rees, Inc.
 - c. Square D Co.
- 4. Nonmetallic Wireways:
 - a. Hoffman Engineering Co.
 - b. Lamson & Sessions; Carlon Electrical Products.
- 5. Boxes, Enclosures, and Cabinets:
 - a. American Electric; FL Industries.
 - b. Butler Manufacturing Co.; Walker Division.
 - c. Crouse-Hinds; Div. of Cooper Industries.
 - d. Electric Panelboard Co., Inc.
 - e. Erickson Electrical Equipment Co.
 - f. Hoffman Engineering Co.; Federal-Hoffman, Inc.
 - g. Hubbell Inc.; Killark Electric Manufacturing Co.
 - h. Hubbell Inc.; Racor, Inc.
 - i. Lamson & Sessions; Carlon Electrical Products.
 - j. O-Z/Gedney; Unit of General Signal.
 - k. Parker Electrical Manufacturing Co.
 - l. Robroy Industries, Inc.; Electrical Division.
 - m. Scott Fetzer Co.; Adalet-PLM.
 - n. Spring City Electrical Manufacturing Co.
 - o. Thomas & Betts Corp.
 - p. Woodhead Industries, Inc.; Daniel Woodhead Co.

2.02 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. LFMC: Flexible steel conduit with PVC jacket.
- C. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.03 METAL WIREWAYS

- A. Material: Sheet metal sized and shaped as indicated.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

SECTION 16130 RACEWAYS AND BOXES

- D. Wireway Covers: As indicated
- E. Wireway Covers: Hinged type.
- F. Wireway Covers: Screw-cover type.
- G. Wireway Covers: Flanged-and-gasketed type.
- H. Finish: Galvanized steel.

2.04 NONMETALLIC WIREWAYS

- A. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captivated screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.05 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.
- C. Nonmetallic Boxes: NEMA OS 2.

2.06 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1.

2.07 ENCLOSURES AND CABINETS

- A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
- B. Cabinets: Unless otherwise noted or specified, NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

SECTION 16130 RACEWAYS AND BOXES

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 WIRING METHODS

- A. Outdoors: Use the following wiring methods:
 - 1. Exposed: Rigid steel.
 - 2. Concealed: Rigid steel.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 4. Boxes and Enclosures: NEMA 250, Type 4 stainless steel.
- B. Indoors: Use the following wiring methods:
 - 1. Exposed: Rigid steel.
 - 2. Concealed: Rigid steel.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 4. Damp or Wet Locations: Rigid steel conduit.
 - 5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

3.03 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: 1/2-inch trade size (DN16).
- C. Conceal conduit, unless otherwise indicated, within finished walls, ceilings, and floors.
- D. Install raceways level and square and at proper elevations. Provide adequate headroom.
- E. Complete raceway installation before starting conductor installation.
- F. Support raceways as specified in "Supporting Devices".

SECTION 16130 RACEWAYS AND BOXES

- G. Use temporary closures to prevent foreign matter from entering raceways.
- H. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- I. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- J. Use raceway fittings compatible with raceways and suitable for use and location.
- K. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- L. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
- M. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
 - 1. Run parallel or banked raceways together, on common supports where practical.
 - 2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- N. Join raceways with fittings designed and approved for the purpose and make joints tight.
 - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 - 2. Use insulating bushings to protect conductors.
- O. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

SECTION 16130 RACEWAYS AND BOXES

- P. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- Q. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.
- R. Telephone and Signal System Raceways, 2-Inch Trade Size (DN53) and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- S. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound.
 - 1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- T. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; LFMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
- U. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semi recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- V. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.04 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

SECTION 16130 RACEWAYS AND BOXES

3.05 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

SECTION 16139

UNDERGROUND ELECTRICAL CONDUIT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Special Conditions and Specification sections, apply to work specified in this section.

1.02 RELATED WORK AND REQUIREMENTS

- A. Section - Basic Electrical Materials and Methods.
- B. Section - Cast-In-Place Concrete.
- C. Section- Grounding.

1.03 DESCRIPTION

- A. Watertight underground conduit system for electrical power distribution, branch circuits, feeders, communication and control cables.

PART 2 - PRODUCTS

2.01 CONDUIT AND ACCESSORIES

- A. Conduit:
 - 1. Polyvinyl chloride (PVC), schedule 80.
- B. Elbows:
 - 1. Elbows and bends with a minimum radius of 48 inches for 5 inches and larger duct, and 36 inches for smaller ducts.
- C. Spacers:
 - 1. Spacers to space and support conduits during concrete pour.
- D. Bell Ends, Bushings, and Plugs:
 - 1. Bell ends of appropriate sizes.

SECTION 16139 UNDERGROUND ELECTRICAL CONDUIT

2. Bushings of appropriate sizes.
3. Closure caps or plugs of same material as conduit.

E. Pull Wire:

1. Provide poly cord in each duct.

F. Grounding:

1. Provide groundable end bushings on metal ducts and connect to a ground rod or ground bus in accordance with Section 16452.

G. Drainage Assembly:

1. Provide 1/2-inch drainage assembly.

2.02 CONCRETE ENCASEMENT

- A. Concrete shall be in accordance with requirements of Section Cast-in-Place Concrete.
- B. Add red dye to top 1/4 inch of poured concrete mix.
- C. Encase duct with 3-inch minimum of concrete on top, bottom, and sides.

2.03 PULL BOXES

- A. Provide cast-in-place or precast pull boxes as detailed on plans.

PART 3 - EXECUTION

3.01 EXCAVATIONS

- A. Excavate trenches for conduit to adequate width, depth, and proper slope.

3.02 PLACEMENT OF CONDUITS

- A. Complete entire section of conduit from pull box to pull box or from pull box to building before encasement by concrete.
- B. Top of conduit shall be a minimum of 24 inches below finished grade for direct buried conduit.
- C. Direct buried conduits shall be run parallel to each other and space shall be maintained between conduits (spaced on center of at least three times conduit trade diameter). Conduit crossovers shall be avoided as much as possible. Where conduits cross each other, conduits shall not be in direct contact with each other.

SECTION 16139 UNDERGROUND ELECTRICAL CONDUIT

- D. Fasten or anchor conduit securely to prevent movement during placement of concrete.
- E. Install spacers as recommended by conduit manufacturer but not to exceed a maximum of 6 foot - 0 inches on center.
- F. Direct buried conduit that stub-up into equipment at both ends shall be straight to within 1/2 inch per 100 feet in both vertical and horizontal directions.
- G. Conduits in ductbanks that terminate in pull boxes shall be straight to within 1/2 inch per 100 feet horizontally and shall have a slope to allow condensation to migrate to the manhole or pull box. Minimum pitch shall be 4 inches per 100 feet.
- H. Provide accurate locations of conduit on record drawings.
- I. Install not more than three 90 degrees bends or equivalent between pull-points.
- J. Provide pull boxes in conduit runs so that there is not more than 300 feet between pull points.
- K. Install bell ends on duct at manholes and pull boxes.
- L. Install bushings on duct ends in equipment enclosure.
- M. Provide water tight conduit systems.
- N. Plug or cap empty conduits.
- O. Pull a mandrel, one size smaller than conduit, through all PVC conduit after installation and/or after concrete pour.
- P. In pull boxes center cables at entrance of conduit and seal with waterproof nonhardening mastic compound.

3.03 PLACEMENT OF CONCRETE

- A. Install forms on sides of ductbank if trench is not of proper firmness to prevent cave-in.
- B. Place concrete continuously from pull point to pull point without interruption.
- C. Extend concrete envelope to finish floor grade in buildings or finish pad grade at equipment.

SECTION 16139 UNDERGROUND ELECTRICAL CONDUIT

3.04 EXCAVATION AND BACKFILLING

A. General:

1. This Contractor shall perform all excavation of every description required for his work, and of whatever substances encountered, to the depths indicated on the Drawings or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted as indicated on the Drawings or as requested by the Architect.
2. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or other approved methods.
3. Such sheeting and shoring shall be done as may be necessary for the protection of the work and for the safety of personnel.
4. Unless otherwise indicated, excavation shall be by open cut. Each excavation shall comprise all materials, and shall include clay, silt, sand, rock, muck, gravel, hardpan, loose shale, and loose stone.
5. Open trench sufficiently ahead of pipe laying to reveal obstructions.
6. Provide trench crossing as necessary to accommodate public travel.
7. Contractor shall file written "notification of excavation" with all utility companies at least three (3) days prior to excavation.
8. Backfill trenches only after piping has been inspected, and locations of pipelines and appurtenances have been recorded.
9. For a depth of 12 inches above the top of the duct bank or conduit backfill by hand with material specified for Compacted Backfill. Tamp this backfill thoroughly in layers not exceeding 6" in thickness, taking care not to disturb the duct bank or conduit.
10. For the remaining trench depth backfill and compact with material as specified in the following paragraphs.
11. Jetting the backfill with water will not be permitted.

3.05 TRENCH EXCAVATING

- A. Trenches shall be of necessary width of the proper laying of the pipe but not more than 16" wider than the duct bank or conduit diameter, and the banks shall be as nearly vertical as practicable. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of conduit or duct bank on undisturbed soil at every point along its entire length. Except where rock is encountered, care shall be taken not to excavate below the depths indicated.
- B. Where rock excavations are required, the rock shall be excavated to a minimum overdepth of four inches below the trench depths indicated on the Drawings or specified. Overdepths in the rock excavations and authorized overdepths shall be backfilled with loose granular material properly compacted.

SECTION 16139 UNDERGROUND ELECTRICAL CONDUIT

- C. Whenever wet or otherwise unstable soil that is incapable of properly supporting the duct bank or conduit, as determined by the Engineer, is encountered in the bottom of the trench, such soil shall be removed to the depth required and the trench backfilled to the proper grade with coarse sand, fine gravel or other suitable material, as hereinafter specified.
- D. Keep trenches free from water while construction therein is in progress. Under no circumstances lay conduit or install duct bank or appurtenances in water. Pump or bail water from bell holes to permit proper jointing of pipes. Conduct the discharge from trench dewatering to drains or natural drainage channels.

3.06 GRADING TRENCH BOTTOM

- A. Shape bottom of trench for Class C bedding, except as otherwise noted. Perform final grading of trench bottoms by hand tools. Grade the bottom of trenches evenly to ensure bearings for all conduit or duct banks. Cut holes as necessary for joints and jointmaking.

3.07 DEPTH OF COVER

- A. Trenches for utilities shall be of a depth that will provide the following minimum depths of cover from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown:
 - 1. -3 feet minimum cover: Main Power Service Entrance
 - 2. -2-1/2 feet minimum cover: Branch Circuits
 - 3. -2 feet minimum cover: Communication Systems
- B. All underground raceways shall have a minimum of 3" of clean sand on sides and orange plastic marker ribbon on top of sand fill.

3.08 NORMAL BACKFILL

- A. Where compacted backfill is not specified the trenches shall be carefully backfilled with the excavated materials for backfilling of earth, loam, sandy clay, sand and gravel, soft shale or other approved materials, free from large clods of earth or stones over 2-1/2" maximum dimension, deposited in 12" layers and compacted.
- B. The surfaces shall be graded to a reasonable uniformity and the mounding over trenches left in a uniform and neat condition as approved by Engineer.

3.09 COMPACTED BACKFILL

- A. Compacted backfill shall be used under the slab on grade, around light pole bases, slabs within the building structure, concrete paving and asphaltic concrete paving. The soils

SECTION 16139 UNDERGROUND ELECTRICAL CONDUIT

used in the fill shall be granular in nature and shall not contain roots, sod, rubbish or stones over 2-1/2" maximum dimension. The Engineer may reject any on-site or borrow materials which he considers unsuitable for the intended use of the fill.

B. Required Density:

1. All fills shall be compacted to a dry density equal to at least 95 percent of the maximum density determined in accordance with the Procter Test, ASTM D 698-66T or modified D 1557-66T. The maximum density and optimum moisture content shall be determined by the Engineer on the basis of laboratory tests conducted on the materials and used in the fill.

C. Control Tests:

1. Adequacy of compaction shall be determined on the basis of inplace density determinations that are to be conducted while the fills are being placed. The results of these tests shall be the basis on which satisfactory completion of the work is judged. Should the fills fail to meet the specified densities, the Contractor shall remove and recompact the soils until the specified densities are achieved.

D. Equipment:

1. The choice of compaction equipment shall be made by the Contractor; however, the equipment shall be adequate for achieving the specified densities. To achieve adequate compaction at locations inaccessible to roller type equipment, use of hand operated, power driven compaction equipment may be necessary.
2. Restore areas to original conditions or as indicated on drawings after installation of underground conduit.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes various types of receptacles, connectors, switches, and finish plates.

1.03 SUBMITTALS

- A. Submit the following according to the Conditions of the Contract and Specification Sections.
- B. Product data for each product specified.
- C. Samples of devices and device plates for color selection and evaluation of technical features.
- D. Operation and maintenance data for materials and products specified in this Section to include in the "Operating and Maintenance Manual".

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70 "National Electrical Code" for devices and installation.
- B. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

1.05 COORDINATION

- A. Wiring Devices for Owner Furnished Equipment: Match devices to plug connectors for Owner-furnished equipment.

SECTION 16140 WIRING DEVICES

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiring Devices:
 - a. Arrow Hart Div., Cooper Industries.
 - b. General Electric Co.
 - c. Hubbell Inc.
 - d. Killark Electrical Mfg. Co.
 - e. Leviton Mfg. Co., Inc.
 - f. Pass & Seymour/Legrand.
 - g. Pyle-National Co.

2.02 WIRING DEVICES

- A. Comply with NEMA Standard WD 1, "General Purpose Wiring Devices."
- B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.
- C. Color: Brown except as otherwise indicated or required by Code.
- D. Receptacles, Straight-Blade and Locking Type: Except as otherwise indicated, comply with Federal Specification W-C-596 and heavy-duty grade of UL Standard 498, "Electrical Attachment Plugs and Receptacles." Provide NRTL labeling of devices to verify these compliances.
- E. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:
 - 1. Ground-Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, "Ground Fault Circuit Interrupters," feed-through type, with integral NEMA 5-20R duplex receptacle arranged to protect connected downstream receptacles on the same circuit. Design units for installation in a 2-3/4-inch (70-mm) deep outlet box without an adapter.
- F. Receptacles, Industrial Heavy-Duty: Conform to NEMA Standard PK 4 "Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type for Industrial Use."

SECTION 16140 WIRING DEVICES

- G. Snap Switches: Quiet-type a.c. switches, NRTL listed and labeled as complying with UL Standard 20 "General Use Snap Switches," and with Federal Specification W-S-896.
- H. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:
 - 1. Color: Matches wiring device except as otherwise indicated.
 - 2. Plate-Securing Screws: Metal with heads colored to match plate finish.
 - 3. Material for Finished Spaces: 0.04-inch-thick (1-mm-thick), type 302, satin-finished stainless steel, except as otherwise indicated.
 - 4. Material for Unfinished Spaces: Galvanized steel.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- D. Protect devices and assemblies during painting.

3.02 IDENTIFICATION

- A. Comply with Section "Electrical Identification."

3.03 FIELD QUALITY CONTROL

- A. Testing: Test wiring devices for proper polarity and ground continuity. Operate each operable device at least 6 times.
- B. Test ground-fault circuit interrupter operation with both local and remote fault simulations according to manufacturer recommendations.
- C. Replace damaged or defective components.

3.04 CLEANING

- A. General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

SECTION 16140 WIRING DEVICES

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Special Conditions and Specification sections, apply to work specified in this section.

1.02 RELATED WORK AND REQUIREMENTS

- A. Section 16050 - Basic Materials and Methods.

1.03 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 - 1. Underwriters' Laboratories, Inc. (UL).
 - 2. UL Standard 969.
- B. Reference Standards:
 - 1. National Electrical Manufacturers Association (NEMA).
 - 2. NEMA Standards Publication / No. WC-1 and WC-2.
- C. National Electrical Contractors Association (NECA):
 - 1. NECA - Standard of Installation.
- D. ANSI Compliance
 - 1. ANSI Standard A13.1.
- E. Occupational Safety and Health Agency (OSHA)
 - 1. OSHA 1910:145

SECTION 16195 ELECTRICAL IDENTIFICATION

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Provide electrical identification products of one of the following (for each type marker):
 - 1. Brady, W.H. Company
 - 2. Ideal Industries, Inc.
 - 3. National Band and Tag Company.
 - 4. Panduit Corporation.
- B. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

2.02 CABLE/CONDUCTOR IDENTIFICATION BANDS

- A. Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type; either pre- numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.

2.03 ENGRAVED PLASTIC LAMINATE SIGNS

- A. Provide engraving stock melamine plastic laminate with white core plies (letter color), in sizes and thicknesses indicated. Engrave laminate with engraver's standard letter style of sizes and wording indicated, and punch for mechanical fastening.
- B. Thickness:
 - 1. 1/16 inch, for units up to 20 square inches or 8 inch length; 1/8 inch for larger units.
- C. Fasteners:
 - 1. Self-tapping stainless steel screws, except contact type permanent commercial grade adhesive providing a permanent bond shall be used where screws cannot or should not penetrate substrate.
 - 2. Two-sided tape and dynamo type adhesives are not acceptable.

2.04 LETTERING AND GRAPHICS

- A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

SECTION 16195 ELECTRICAL IDENTIFICATION

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.
- B. Coordination:
 - 1. Where identification is to be applied to surfaces that require finish, install identification after completion of painting.
- C. Regulations:
 - 1. Comply with governing regulations and requests of governing authorities for identification of electrical work.

3.02 UNDERGROUND CONDUIT IDENTIFICATION

- A. During back filling/top soiling of each exterior underground electrical conduit, install a continuous underground type plastic line marker, located directly over buried conduit at 6 inches to 8 inches below finished grade. Where multiple small conduits are buried in a common trench and do not exceed an overall width of 16 inches, install a single line marker.

3.03 CABLE/CONDUCTOR IDENTIFICATION

- A. Apply cable/conductor identification at origin and terminus. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.
- B. At each junction box, the covers on junction boxes and pull boxes in areas that are not to be painted shall be marked with "Indelible Markers" to indicate the circuit number(s) of conductors in the box.
- C. Color code power conductors as indicated:
 - 1. Wire sizes AWG No. 8 and smaller shall have colored insulation.
 - 2. Wire sizes AWG No. 6 and larger shall be identified by color coding tape at each outlet splice point and at each termination.
 - 3. Maintain phase color coding by phase throughout the distribution system.
 - 4. Color-coding shall be as follows:

SECTION 16195 ELECTRICAL IDENTIFICATION

a. 120/280 Volt Systems:

Phase A - Black

Phase B - Red

Phase C - Blue

Neutral - White

Equipment Ground - Green

b. 277/480 Volt Systems:

Phase A - Brown

Phase B - Orange

Phase C - Yellow

Neutral - Gray

Equipment Ground - Green

3.04 OPERATIONAL IDENTIFICATION AND WARNINGS

- A. Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install plastic signs on switches, outlets and other controls, devices and covers on electrical enclosures.

3.05 DANGER SIGNS

- A. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.

3.06 EQUIPMENT/SYSTEM IDENTIFICATION

- A. Install engraved plastic laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2 inch high lettering on 1-1/2 inch high sign (2 inch high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings.
- B. Engraved laminate signs shall have white lettering in a black field.
- C. Provide signs for each unit of the following categories of electrical work:
1. Panelboards, electrical power and signal system cabinets and enclosures located inside of cover or door in finished areas and outside of cover or door in equipment rooms.

SECTION 16195 ELECTRICAL IDENTIFICATION

2. Panelboard identification shall indicate panelboard designation and voltage, i.e., "PANEL 1/A - 120/208V, 3 PHASE, 4W."
 3. Major electrical switchgear.
 4. Motor control centers.
 5. Motor starters.
 6. Power transfer equipment.
 7. Transformers.
 8. Disconnect switches.
 9. Junction boxes - 6" x 6" and larger for electrical power and all special systems, i.e., fire alarm, sound, etc.
- D. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners.
- E. Each feeder disconnect switch or circuit breaker in switchboards, power panelboards, or motor control centers shall be identified with a laminated plastic nameplate. Inscriptions shall indicate the device served i.e. "Panel LI", HVAC Unit #1, etc.
- 3.07 ENGRAVED COVER PLATES
- A. All cover plates for control stations controlling remote equipment shall be engraved to identify the device being controlled.

END OF SECTION

SECTION 16195 ELECTRICAL IDENTIFICATION

SECTION 16452

GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section "Wires and Cables" for requirements for grounding conductors.

1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections.
- B. Product Data for grounding rods, connectors and connection materials, and grounding fittings.
- C. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Field tests and observation reports certified by the testing organization and indicating and interpreting the test reports for compliance with performance requirements.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, or a full member company of the InterNational Electrical Testing Association (NETA).

SECTION 16452 GROUNDING

1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Comply with NFPA 70.
- C. Comply with UL 467.
- D. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Apache Grounding; Nashville Wire Products.
 2. Boggs: H. L. Boggs & Co.
 3. Chance: A. B. Chance Co.
 4. Dossert Corp.
 5. Erico Inc.; Electrical Products Group.
 6. Galvan Industries, Inc.
 7. Hastings Fiber Glass Products, Inc.
 8. Heary Brothers Lightning Protection Co.
 9. Ideal Industries, Inc.
 10. ILSCO.
 11. Kearney.
 12. Korns: C. C. Korns Co.
 13. Lightning Master Corp.
 14. Lyncole XIT Grounding.
 15. O-Z/Gedney Co.
 16. Raco, Inc.
 17. Salisbury: W.H. Salisbury & Co., Utility.
 18. Thomas & Betts, Electrical.
 19. Utilco Co.

SECTION 16452 GROUNDING

2.02 GROUNDING AND BONDING PRODUCTS

- A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.03 WIRE AND CABLE GROUNDING CONDUCTORS

- A. Comply with "Wires and Cables section." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
- B. Equipment Grounding Conductors: Insulated with green color insulation.
- C. Grounding-Electrode Conductors: Stranded cable.
- D. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
- E. Bare Copper Conductors: Conform to the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.

2.04 MISCELLANEOUS CONDUCTORS

- A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.
- B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.
- C. Bonding Straps: Soft copper, 0.05 inch (1 mm) thick and 2 inches (50 mm) wide, except as indicated.

2.05 CONNECTOR PRODUCTS

- A. Pressure Connectors: High-conductivity-plated units.
- B. Bolted Clamps: Heavy-duty type.
- C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

SECTION 16452 GROUNDING

2.06 GROUNDING ELECTRODES AND TEST WELLS

- A. Grounding Rods: Sectional type; copper-clad steel.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
 - 3. Install equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:
 - a. Feeders and branch circuits.
 - b. Receptacle circuits.
 - c. Single-phase motor or appliance branch circuits.
 - d. Three-phase motor or appliance branch circuits.
 - e. Flexible raceway runs.
 - 4. Busway Supply Circuits: Install separate equipment grounding conductor from the grounding bus in the switchgear, switchboard, motor control center or distribution panel to equipment grounding-bar terminal on busway.
- B. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-26.

3.02 INSTALLATION

- A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- B. Grounding Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.
 - 1. Drive until tops are 2 inches (50 mm) below finished floor or final grade, except as otherwise indicated.
 - 2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.
- C. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- D. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 inches (600 mm) below grade.

SECTION 16452 GROUNDING

- E. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.
- F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.
- G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

3.03 CONNECTIONS

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

SECTION 16452 GROUNDING

- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.04 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Handholes: Install a driven grounding rod close to wall and set rod depth so 4 inches (100 mm) will extend above finished floor. Where necessary, install grounding rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from grounding rod into manhole through a waterproof sleeve in manhole wall. Protect grounding rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
- B. Connections to Handhole Components: Connect exposed metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to grounding rod or grounding conductor. Make connections with minimum No. 4 AWG stranded, hard-drawn copper wire. Train conductors plumb or level around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- C. Grounding System: Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes.

3.05 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Engage an electrical testing organization to perform tests described below.
- B. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any

SECTION 16452 GROUNDING

means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.

C. Maximum grounding to resistance values are as follows:

1. Equipment Rated 500 kVA and Less: 5 ohms.
2. Handhole Grounds: 10 ohms.

D. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

E. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION

SECTION 16452 GROUNDING

SECTION 16476

DISCONNECT SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes individually mounted switches and circuit breakers used for the following:
 - 1. Service disconnect switches.
 - 2. Feeder and equipment disconnect switches.
 - 3. Feeder branch-circuit protection.
 - 4. Motor disconnect switches.

1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections.
- B. Product Data for disconnect switches, circuit breakers, and accessories specified in this Section.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.
- B. Comply with NFPA 70 for components and installation.
- C. Listing and Labeling: Provide disconnect switches and circuit breakers specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

SECTION 16476 DISCONNECT SWITCHES AND CIRCUIT BREAKERS

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide disconnect switches and circuit breakers by one of the following:
 - 1. Switches:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution and Control Division.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D Co.
 - 2. Molded-Case Circuit Breakers:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution and Control Division.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D Co.

2.02 DISCONNECT SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosure:
 - Indoor: NEMA 4X, Stainless Steel
 - Outdoor: NEMA 4X, Stainless Steel

2.03 ENCLOSED CIRCUIT BREAKERS

- A. Enclosed, Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle.
- B. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting rating to meet available fault current.
- C. Application Listing: Appropriate for application, including switching fluorescent lighting loads or heating, air-conditioning, and refrigerating equipment.
- D. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.
- E. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.

SECTION 16476 DISCONNECT SWITCHES AND CIRCUIT BREAKERS

F. Enclosure:

Indoor: NEMA 4X, Stainless Steel
Outdoor: NEMA 4X, Stainless Steel

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install disconnect switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.
- B. Install disconnect switches and circuit breakers, level and plumb.
- C. Connect disconnect switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Identify each disconnect switch and circuit breaker according to requirements specified in Section "Basic Electrical Materials and Methods."

3.02 ADJUSTING

- A. Set field-adjustable disconnect switches and circuit-breaker trip ranges as indicated.

3.03 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION

SECTION 16476 DISCONNECT SWITCHES AND CIRCUIT BREAKERS

SECTION 16495

TRANSFER SWITCHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes transfer switches rated 600 V and less and the following items:
 - 1. Automatic transfer switch.

1.03 SUBMITTALS

- A. Product Data: Include dimensioned plans, sections, and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and materials lists.
- B. Wiring Diagrams: Details of wiring for transfer switch and differentiating between manufacturer-installed and field-installed wiring. Show both power and control wiring.
- C. Product Certificates: Signed by manufacturer certifying that products furnished comply with requirements and that switches have been tested for short-circuit closing and withstand ratings applicable to units for Project.
- D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article.
- E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- F. Maintenance Data: For each type of product to include specified in the maintenance manuals. Include all features and operating sequences, both automatic and manual. List all factory settings of relays and provide relay-setting and calibration instructions.

SECTION 16495 TRANSFER SWITCHES

1.04 QUALITY ASSURANCE

- A. Emergency Service: Manufacturer maintains a service center capable of providing emergency maintenance and repairs at Project site with a 12-hour maximum response time.
- B. Source Limitations: Obtain automatic transfer switch from a single manufacturer who assumes responsibility for all components.
- C. Comply with NFPA 70.
- D. Comply with NEMA ICS 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Conventional Transfer Switches:
 - a. Caterpillar, Inc.; Engine Division.
 - b. Emerson Electric Co.; Automatic Switch Co. Subsidiary.
 - c. Kohler Co.; Generator Division.
 - d. Onan Corp.; Electrical Products Division.
 - e. Russelectric, Inc.

2.02 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Units Smaller than 600 A: Listed without derating for all classes and all mixtures of classes of loads, including 100 percent inductive load.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated based on testing according to UL 1008.
 - 1. Where External Circuit Breaker or Fuses Protect Transfer Switch: Products are listed for use with the actual devices providing the fault-current protection at each location for Project. Rated fault-current, withstand-duration times include the following:
 - a. Units Protected by Molded-Case Circuit Breakers Larger than 150 A: 3 cycles.
- C. Annunciation and Control Interface Components: Devices at transfer switches for communicating with remote annunciators or annunciator and control panels have

SECTION 16495 TRANSFER SWITCHES

communications capability matched with the remote device.

- D. Solid-State Controls: Repetitive accuracy of all settings is plus or minus 2 percent or better over an operating temperature range of minus 20 deg C to 70 deg C.
- E. Resistance to Damage by Voltage Transients: Components meet or exceed voltage-surge withstand capability requirements when tested according to ANSI C37.90.1. Components meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- F. Neutral Terminal: Provide fully rated, solid, unswitched neutral terminal, unless otherwise indicated.
- G. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6; UL 508. Enclosure to be provided with feet and designed for floor mounting.
- H. Factory Wiring: Train and bundle factory wiring and label consistent with Shop Drawings, either by color code or by numbered or lettered wire and cable tape markers at terminations.
 - 1. Designated Terminals: Pressure type suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- I. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric motor-operated mechanism, mechanically and electrically interlocked in both directions.
- J. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switch or insulated-case circuit-breaker components and switches using contactors not designed for continuous-duty repetitive switching between active power sources are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Switch Contacts: Silver composition for load current switching. Conventional automatic transfer-switch units rated 225 A and greater have separate arcing contacts.

2.03 AUTOMATIC TRANSFER SWITCH

- A. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

SECTION 16495 TRANSFER SWITCHES

- B. Manual Switch Operation: Manually operated under load, with the door closed, and with either or both sources energized. Transfer time is the same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

2.04 AUTOMATIC TRANSFER-SWITCH FEATURES

- A. Voltage sensing for each phase of normal source. Pickup voltage is adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
- B. Time delay for override of normal-source voltage sensing delays transfer and engine start signals. Adjustable 0 to 6 seconds and factory set at 3 seconds.
- C. Voltage/Frequency Lockout Relay: Prevents premature transfer to an emergency generator set. Pickup voltage is adjustable from 85 to 100 percent of nominal. Factory set to pickup at 90 percent. Pickup frequency is adjustable from 90 to 100 percent of nominal. Factory set to pickup at 95 percent.
- D. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes and factory set at 10 minutes. Provides automatic defeat of the delay on loss of voltage or sustained undervoltage of the emergency source, provided normal supply has been restored.
- E. Test Switch: Simulates normal-source failure.
- F. Switch-Position Pilot Lights: Indicate source to which load is connected.
- G. Source-Available Indicating Lights: Supervise sources via the transfer-switch, normal- and emergency-source sensing circuits.
 - 1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - 2. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
- H. Unassigned Auxiliary Contacts: 2 normally open single-pole, double-throw contacts for each switch position, rated 10 A at 240 V, ac.
- I. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of the condition of the normal source. A pilot light indicates override status.
- J. Engine Starting Contacts: 1 isolated, normally closed and 1 isolated, normally open. Contacts are gold flashed or gold plated and rated 10 A at 32 V, dc minimum.

SECTION 16495 TRANSFER SWITCHES

- K. Engine Shutdown Contacts: Time delay adjustable from 0 to 5 minutes; factory set at 5 minutes. Initiates shutdown at remote engine-generator controls after retransfer of load to normal source.
- L. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine-generator set and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory-set periods are for 7 days, 20 minutes, and 5 minutes, respectively. Exerciser features include the following:
 - 1. Exerciser Transfer Selector Switch: Permits selection between exercise with and without load transfer.
 - 2. Push-button programming control with digital display of settings.
 - 3. Integral battery operation of time switch when normal control power is not available.

2.05 FINISHES

- A. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

2.06 SOURCE QUALITY CONTROL

- A. Factory Test Components, Assembled Switches, and Associated Equipment: Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Floor Mounting of Switches: Level and anchor unit to floor.
- B. Identify components according to Section "Basic Electrical Materials and Methods."

3.02 WIRING TO REMOTE COMPONENTS

- A. Match type and number of cables and conductors to control and communications requirements of transfer switches used. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

SECTION 16495 TRANSFER SWITCHES

3.03 CONNECTIONS

- A. Ground equipment as indicated and required by National Electrical Code.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.04 FIELD QUALITY CONTROL

- A. Preliminary Tests: Perform electrical tests as recommended by manufacturer and as follows:
 - 1. Measure phase-to-phase and phase-to-ground insulation resistance levels with insulation resistance tester. Include external annunciator and control circuits. Use test voltages and procedure recommended by manufacturer. Meet manufacturer's specified minimum resistance.
 - 2. Check for electrical continuity of circuits and for short circuits.
- B. Field Tests: Give 7 days' advance notice of tests and perform tests in presence of Owner's representative.
- C. Coordinate tests with tests of generator plant and run them concurrently.
- D. Tests: As recommended by manufacturer and as follows:
 - 1. Contact Resistance Test: Measure resistance of power contacts for automatic transfer switches, nonautomatic transfer switches, and bypass/isolation switches. Resolve values in excess of 500 micro-ohms and differences between adjacent poles exceeding 50 percent.
 - 2. Operational Tests: Demonstrate interlocking sequence and operational function for each switch at least 3 times.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate low phase-to-ground voltage for each phase of normal source to automatic transfer switches.
 - c. Verify time-delay settings and pickup and dropout voltages.
- E. Test Failures: Correct deficiencies identified by tests and prepare for retest. Verify that equipment meets specified requirements.
- F. Reports: Maintain a written record of observations and tests. Report defective materials and workmanship and retest corrected items. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

SECTION 16495 TRANSFER SWITCHES

3.05 DEMONSTRATION

- A. Training: Engage a factory-authorized service representative to instruct Owner's personnel in the operation, maintenance, and adjustment of transfer switches and related equipment. Provide a minimum of 2 hours of instruction scheduled 7 days in advance.

END OF SECTION

SECTION 16495 TRANSFER SWITCHES