

ATTACHMENT A

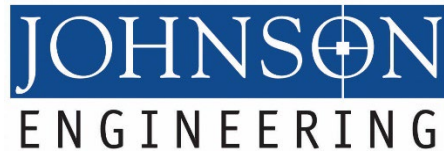
TECHNICAL SPECIFICATIONS

LAKES PARK WATER QUALITY PHASE 3



**2115 SECOND STREET
Fort Myers, Florida 33901
(239) 533-2221**

Prepared By:



**Johnson Engineering, Inc., E.B. 642
2122 Johnson Street Fort Myers,
Florida 33901
(239) 334-0046**

This item has been digitally signed and sealed by Jordan L. Varble, P.E., on the date adjacent to the seal.

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MARCH 2024

LEE COUNTY

LAKES PARK WATER QUALITY – PHASE 3

TECHNICAL SPECIFICATIONS

REFERENCE DOCUMENTS

The Contractor shall complete all work in conformance with the Lee County Utilities Design Manual, latest revision, and as provided herein these technical specifications. The latest version of the Design Manual is available at the Lee County website:

<https://www.leegov.com/utilities/design-manual>

Contractor shall complete all applicable work in conformance with the latest version of the FDOT indices: <https://www.fdot.gov/design/standardplans/current/default.shtm>

All utility related materials shall comply with Lee County Utility's Approved Materials List:

<https://www.leegov.com/utilities/design-manual/approved-materials>

**LEE COUNTY
LAKES PARK WATER QUALITY – PHASE 3
TECHNICAL SPECIFICATIONS**

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description of Work
- B. Constraints
- C. Work by Others
- D. CONTRACTOR's Use of Site
- E. Work Sequence
- F. Owner Occupancy

1.2 DESCRIPTION OF WORK

- A. General: The Work to be done under this Contract consists of furnishing tools, equipment, materials, supplies, manufactured articles, and furnishing all labor, transportation, and services specified in Contract Documents.
- B. The Work includes:
 - 1. Furnishing of all labor, material, superintendence, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary or proper for performing and completing the Work.
 - 2. Maintaining the Work area and site in a clean and acceptable manner.
 - 3. Maintaining existing facilities in service at all times except where specifically provided for otherwise herein.
 - 4. Protection of finished and unfinished Work.
 - 5. Repair and restoration of Work damaged during construction.

6. Furnishing as necessary proper equipment and machinery, of a sufficient capacity, to facilitate the Work and to handle all emergencies normally encountered in Work of this character.
 7. Furnishing, installing, and protecting all necessary guides, track rails, bearing plates, anchor and attachment bolts, and all other appurtenances needed for the installation of the devices included in the equipment specified. Make anchor bolts of appropriate size, strength and material for the purpose intended. Furnish substantial templates and shop drawings for installation.
 8. Implementation of a pumping and recirculation treatment system consisting of a bulk storage tank, intake pipeline, treatment pumping and control system, and outfall lines with discharge points throughout the lake.
- C. Implied and Normally Required Work: It is the intent of these Specifications to provide the OWNER with complete operable systems, subsystems and other items of Work. Any part or item of Work which is reasonably implied or normally required to make each installation satisfactorily and completely operable is deemed to be included in the Work and the Contract Amount. All miscellaneous appurtenances and other items of Work incidental to meeting the intent of these Specifications are included in the Work and the Contract Amount even though these appurtenances may not be specifically called for in these Specifications.
- D. Quality of Work: Regard the apparent silence of the Contract Documents 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 as meaning that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Interpretation of these specifications will be made upon this basis.

1.3 CONSTRAINTS

- A. The Contract Documents are intended to allow the CONTRACTOR flexibility in construction of the Work, however, the following constraints apply:

See Construction Plans for supplementary requirements.

1.4 WORK BY OTHERS

Not Used.

1.5 CONTRACTOR'S USE OF SITE

- A. In addition to the requirements of the General Conditions, limit use of site and premises for work and storage to allow for the following:
 - 1. Continued use of all park facilities by park visitors.
 - 2. Coordination of the Work under this CONTRACT with the work of the other contractors where Work under this CONTRACT encroaches on the Work of other contractors.
 - 3. OWNER and park visitor occupancy and access to operate existing facilities.
 - 4. Coordination of site use with ENGINEER.
 - 5. Responsibility for protection and safekeeping of products under this CONTRACT.
 - 6. Providing additional off-site storage at no additional cost to OWNER as needed.

1.6 WORK SEQUENCE

- A. Construct Work in stages to accommodate OWNER and park guests' use of premises during construction period and in accordance with the limitations on the sequence of construction specified. Coordinate construction schedules and operations with ENGINEER.
- B. Coordinate Work of all subcontractors.

1.7 OWNER OCCUPANCY

- A. OWNER will occupy premises and park shall remain open during entire period of construction in order to maintain normal operations. Cooperate with OWNER's representative in all construction operations to minimize conflict, and to facilitate OWNER usage.
- B. Conduct operations so as to inconvenience the general public in the least.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

- A. Starting Work: Start Work within 10 days following the date stated in the Notice to Proceed and execute with such progress as may be required to prevent delay to other contractors or to the general completion of the project. Execute Work at such items and in or on such parts of the project, and with such forces, material and equipment, as to complete the Work in the time established by the Contract. At all times, schedule and direct the Work so that it provides an orderly progression to completion within the specified time for completion.

END OF SECTION

SECTION 01 22 13

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Explanation and Definitions
- B. Measurement
- C. Payment
- D. Schedule of Values

1.2 EXPLANATION AND DEFINITIONS

- A. The following explanation of the Measurement and Payment for the bid form items is made for information and guidance. The omission of reference to any item in this description shall not, however, alter the intent of the bid form or relieve the CONTRACTOR of the necessity of furnishing such as a part of the Contract.

1.3 MEASUREMENT

- A. The quantities set forth in the bid form are approximate and are given to establish a uniform basis for the comparison of bids. The OWNER reserves the right to increase or decrease the quantity of any class or portion of the work during the progress of construction in accord with the terms of the Contract.

1.4 PAYMENT

- A. Payment shall be made for the items listed on the Bid Form on the basis of the work actually performed and completed, such work including but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, clean up, restoration of disturbed areas, and all other appurtenances to complete the construction and installation of the work as shown on the drawings and described in the specifications.
- B. Unit prices are used as a means of computing the final figures for bid and Contract purposes, for periodic payments for work performed, for determining value of additions or deletions and wherever else reasonable.

1.5 SCHEDULE OF VALUES

- A. Approval of Schedule: Submit for approval a preliminary schedule of values, in duplicate, for all of the Work. Prepare preliminary schedule in accordance with the General Conditions. Submit preliminary schedule of values within 10 calendar days after the Effective Date of the Agreement. Submit final schedule of values in accordance with the General Conditions.
- B. Format: Utilize a format similar to the Table of Contents of the Project Specifications. Identify each line item with number and title of the major specification. Identify site mobilization, bonds and insurance. Include within each line item, a direct proportional amount of CONTRACTOR's overhead profit.
- C. Revisions: With each Application for Payment, revise schedule to list approved Change Orders.

PART 2 EXECUTION

2.1 MEASUREMENT AND PAYMENT

- A. Payment shall be made on the basis of work actually performed completing each item in the Bid, such work including, but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, cleanup, and all other appurtenances to complete the construction and installation of the work to the configuration and extent as shown on the drawings and described in the specifications. Payment for each item includes compensation for cleanup and restorations. Cleanup and surface restorations (including pavement replacement) will be considered as ten percent (10%) of each pay item and complete payment will not be made until cleanup, restorations and as-builts are completed.
 - 1. Mobilization/Demobilization: Payment for mobilization will be made at the Contract lump sum price for the contractor's cost for mobilization, demobilization, and other applicable administrative charges as outlined in the Contract Documents and specified herein. 75% will be paid for mobilization in equal increments on the first (1st) and second (2nd) partial pay estimates paid on the contract and 25% on the final invoice for demobilization.
 - 2. Maintenance of Traffic: Payment for maintenance of traffic will be made for at the Contract lump sum price. The M.O.T. shall include, but is not limited to, furnishing and installing barricades and safety fencing to protect the public during the construction of the project.
 - 3. Preconstruction Video: Payment for audio-video tape of existing conditions at the site will be made for at the Contract lump sum price.

4. Erosion and Sedimentation Control: Payment for erosion and sedimentation control will be made for at the Contract lump sum price. Payment shall include all equipment, labor, and materials required to prepare and implement a Stormwater Pollution Prevention Plan including preparing and filing necessary regulatory forms and providing certifications at completion of project.
5. Existing Catch Basin Modifications: Payment for modifying the existing catch basin will be made at the Contract unit price. This item includes all equipment, labor, and materials required for installation and operation.
6. Bollard: Payment for removable lock bollards will be made at the Contract unit price per bollard installed. This includes all costs associated with the installation and operation.
7. Roof and Foundation for Storage Tank: Payment for the roof/shelter and building foundation for the alum storage tank will be made for at the Contract lump sum price. This item includes plumbing, electrical, and all other equipment, labor, and materials required for installation and operation.
8. Fencing: Payment for fencing will be made for at the Contract unit price per linear foot of fencing installed and accepted, up to the planned quantity. This item includes aesthetic features and all other equipment, labor, and materials required for installation, as shown in the Drawings.
9. Alum Tank Fill Structure: Payment for the alum fill structure and appurtenances will be made for at the Contract lump sum price. Payment includes all equipment, labor, and materials, including hatch, required for installation and operation.
10. Alum Storage Tank: Payment for the alum storage tank and appurtenances will be made for at the Contract lump sum price. Payment includes all equipment, labor, and materials, including minor materials and hardware not shown on the plans but which can be reasonably anticipated as necessary to achieve the intent of the construction plans, required for installation and operation.
11. Alum Treatment System: Payment for the alum treatment system will be made for at the Contract lump sum price. This item includes, but is not limited to the pumps, building, wet well, sensors, piping, filters, plumbing, labor, training, testing, equipment calibration, electrical, instrumentation, controls, any other subcomponents required for operation of the system, including minor materials and items not indicated on the plans but which can be reasonably anticipated to be necessary to construct the system.

12. Motor Operated Valve: Payment for the motor operated valves will be made for at the Contract unit price per valve acceptably installed. This item includes the valve, enclosure, electrical, controls, and all necessary labor, materials, and equipment for installation and operation.
13. Pipelines: Payment for furnishing and installing pipelines (various sizes and types) will be made at the Contract unit price per lineal foot for the pipe in place. This item includes all necessary fittings, labor, equipment, and materials for furnishing, laying, and operation of the pipe, compaction, pipe bedding, backfilling, sheeting, restrained joint piping, mylar detectable tape, sleeve, clamps, harnessing, plugs and caps, adapters, excavation of all material encountered including rock, clearing and grubbing, culverts, and other surface materials not specifically designated in the Bid, clean-up, and tests. Measurement of the pipe shall be to the nearest foot along the centerline including the length of valves and fittings. Lineal footage measurement shall be horizontal.
14. Storm Sewer Cleaning: Payment for storm sewer cleaning will be made at the Contract unit price per lineal foot of storm culvert cleaned and inspected. This item includes all necessary labor, equipment, and materials for flushing the culvert until clean and hauling and disposal of sediment. Measurement of the pipe shall be to the nearest foot along the centerline of the pipe. Lineal footage measurement shall be horizontal. Payment will be made after submittal of an inspection report with video documentation demonstrating the line is clean.
15. Injection Apparatus: Payment for the pond alum injection apparatus will be made for at the Contract unit price per apparatus acceptably installed. This item includes all equipment, labor, and materials required for installation and operation.
16. Asphalt Repair: Payment for roadway and pedestrian paths repair will be made for at the Contract lump sum price for pavement surface, base, and subgrade installed in the work. This item includes all equipment, labor, and materials required for installation and operation.
17. Sod Installation: Payment for sod installation will be made for at the Contract unit price per square yard of sod required and accepted. Payment shall include all equipment, materials, and labor necessary for a complete installation and establishment, including watering, fertilizing, and mowing until project completion.

END OF SECTION

SECTION 01 31 13
PROJECT COORDINATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Work Progress
- B. Private Land
- C. Work Locations
- D. Open Excavations
- E. Test Pits
- F. Maintenance of Traffic
- G. Maintenance of Flow

1.2 WORK PROGRESS

- A. Furnish personnel and equipment which will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will allow the completion of the work within the time stipulated in the Bid of these Specifications. If at any time such personnel appears to the ENGINEER to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the CONTRACTOR to increase the efficiency, change the character or increase the personnel and equipment, and the CONTRACTOR shall conform to such order. Failure of the ENGINEER to give such order shall in no way relieve the CONTRACTOR of his obligations to secure the quality of the work and rate of progress.

1.3 PRIVATE LAND

- A. Do not enter or occupy private land outside of easements, except by permission of OWNER. Construction operations shall be conducted in accordance with Section 01 57 00.

1.4 WORK LOCATIONS

- A. Structures and pipelines shall be located substantially as indicated on the Drawings, but the ENGINEER reserves the right to make such modifications in locations as may be found desirable to avoid interference noted on the Drawings, such notation is for the CONTRACTOR's convenience and does not relieve him from laying and jointing different or additional items where required.

1.5 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by the public and workmen.

1.6 TEST PITS

Not Used.

1.7 MAINTENANCE OF TRAFFIC

- A. Maintenance of traffic shall be in accordance with Sections 01 55 26 and 33 05 02.
- B. All projects and work on highways, roads, and streets, shall have a traffic control plan, (TCP), as required by Florida Statute and Federal regulations. All work shall be executed under the established plan and Department approved procedures. The TCP is the result of considerations and investigations made in the development of a comprehensive plan for accommodating vehicular and pedestrian traffic through the construction zone.
- C. The complexity of the TCP varies with the complexity of the traffic problems associated with a project. Many situations can be covered adequately with reference to specific sections from the Manual on Uniform Traffic Control Devices (MUTCD), the Traffic Control Devices Handbook (TCDH), or Roadway and Traffic Design Standard Series 600.

1.8 MAINTENANCE OF FLOW

- A. Provide for the flow of sewers, drains, courses interrupted during the progress of the work, and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the ENGINEER well in advance of the interruption of any flow.

PART 2 PRODUCTS

2.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from damage in any way. No wheeling or 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.
- B. All structures shall be protected in a manner approved by the ENGINEER. Should any of the floors or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the CONTRACTOR at his own expense and to the satisfaction of the ENGINEER. Special attention is directed to substructure bracing requirements, described in Section 31 40 00. If, in the final inspection of the work, any defects, faults or omissions are found, the CONTRACTOR shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. The CONTRACTOR shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the contract.
- C. Take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the OWNER.

PART 3 EXECUTION

3.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. Sequence and schedule work in a manner to preclude delays and conflicts between the work of various trades and contractors. Each trade shall keep informed as to the work of other trades on the project and shall execute their work in a manner that will not interfere with the work of other trades.

3.2 DIAGRAMMATIC NATURE OF DRAWINGS

- A. Where layout is diagrammatic, such as pipelines, conduits, ductwork, etc., it shall be followed as closely as other work will permit. Changes from diagrams shall be made as required to conform to the construction requirements.
- B. Before running lines, carefully verify locations, depths and sizes and confirm that lines can be run as contemplated without interfering with other construction. Any deviation shall be referred to the ENGINEER for approval before lines are run. Minor changes in location of the equipment, fixtures, piping, etc., from those

shown on the Drawings, shall be made without extra charge if so directed by the ENGINEER before installation.

- C. Determine the locations and sizes of equipment, fixtures, conduit, ducts, openings, etc., in order that there will be no interference in the installation of the work or delay in the progress of other work. In the event that interferences develop, the ENGINEER's decision regarding relocation of work will be final.
- D. Any changes made necessary through failure to make proper arrangements to avoid interference shall not be considered as extras. Cooperate with those performing other work in preparation of interference drawings, to the extent that the location of piping, ductwork, etc., with respect to the installations of other trades shall be mutually agreed upon by those performing the work.

3.3 PROVISIONS FOR LATER INSTALLATION

- A. Where any work cannot be installed as the construction is progressing, provide for boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the omitted work during later phases of construction. Arrange for chases, holes, and other openings in the masonry, concrete or other work and provide for subsequent closure after placing equipment. Arrangement for and closure of openings shall be subject to the approval of the ENGINEER and all costs therefor shall be included in the contract price for the work.

3.4 COORDINATION

- A. The CONTRACTOR shall be fully responsible for the coordination of his work and the work of his employees, subcontractors, and suppliers with the OWNER, and regulatory agencies, and assure compliance with schedules.

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination
- B. Preconstruction Conference
- C. Progress Meetings

1.2 COORDINATION

- A. General: Coordinate scheduling, submittals, and Contract work to assure efficient and orderly sequence of installation of interdependent construction elements.

1.3 PRECONSTRUCTION CONFERENCE

- A. General: Prior to commencement of the Work, in accordance with the General Conditions, the OWNER will conduct a preconstruction conference to be held at a predetermined time and place.
- B. Delineation of Responsibilities: The purpose of the conference is to designate responsible personnel, to establish a working relationship among the parties and to identify the responsibilities of the OWNER, plant personnel and the CONTRACTOR/VENDOR. Matters requiring coordination will be discussed and procedures for handling such matters, established. The agenda will include:
 - 1. Submittal procedures
 - 2. Partial Payment procedures
 - 3. Maintenance of Records
 - 4. Schedules, sequences and maintenance of facility operations
 - 5. Safety and First Aid responsibilities
 - 6. Change Orders and Field Directive Changes
 - 7. Use of site
 - 8. Housekeeping
 - 9. Equipment delivery
- C. Attendees: The preconstruction conference is to be attended by the representatives of the CONTRACTOR/VENDOR, the OWNER and plant personnel that will be associated with the project. Representatives of regulatory

agencies, subcontractors, and principal suppliers may also attend when appropriate.

- D. Chair and Minutes: The preconstruction conference will be chaired by the Owner who will also arrange for the keeping and distribution of minutes to all attendees.

1.4 PROGRESS MEETINGS

- A. Meeting Frequency and Format: Schedule progress meetings as warranted by the complexity of the Project, to review the Work, discuss changes in schedules, maintain coordination and resolve potential problems. Invite OWNER, ENGINEER and all subCONTRACTOR/VENDORS. Suppliers may be invited as appropriate. Minutes of the meeting will be maintained by CONTRACTOR/VENDOR and reviewed by ENGINEER prior to distribution by the CONTRACTOR/VENDOR. Distribute reviewed minutes to attendees within 14 calendar days after each meeting.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description of Requirements
- B. Submittal Procedures
- C. Specific Submittal Requirements
- D. Action on Submittals
- E. Repetitive Review

1.2 DESCRIPTION OF REQUIREMENTS

- A. This section specifies procedural requirements for Shop Drawings, product data, samples, and other miscellaneous Work-related submittals.
- B. Procedures concerning items such as listing of manufacturers, suppliers, subcontractors, construction progress schedule, schedule of Shop Drawing submissions, bonds, payment applications, insurance certificates, and schedule of values are specified elsewhere.
- C. Work-Related Submittals:
 - 1. Substitution or "Or Equal" Items:
 - a. Includes material or equipment CONTRACTOR requests ENGINEER to accept, after Bids are received, as substitute for items specified or described in Specifications by using name of a proprietary item or name of particular supplier.
 - 2. Shop Drawings:
 - a. Includes technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.

- b. Standard information prepared without specific reference to the Project is not considered a Shop Drawing.
- 3. Product Data:
 - a. Includes standard printed information on manufactured products, and systems that has not been specially prepared for this Project, including manufacturer's product specifications and installation instructions, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.
- 4. Samples:
 - a. Includes both fabricated and manufactured physical examples of materials, products, and units of work, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing.
 - b. Mock-ups are special forms of samples which are too large or otherwise inconvenient for handling in manner specified for transmittal of sample submittals.
- 5. Working Drawings:
 - a. When used in the Contract Documents, the term "working drawings" shall be considered to mean the CONTRACTOR'S plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities control systems, forming and falsework for underpinning; temporary by-pass pumping and for such other work as may be required for construction but does not become an integral part of the project.
 - b. Copies of working drawings shall be submitted to the ENGINEER at least fourteen (14) calendar days (unless otherwise specified by the ENGINEER) in advance of the required work.
 - c. Working drawings shall be signed by a registered Professional Engineer currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use.
- 6. Miscellaneous Submittals:
 - a. Work-related submittals that do not fit in the previous categories, such as guarantees, warranties, certifications, experience records,

maintenance agreements, Operating and Maintenance Manuals, workmanship bonds, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, and similar information, devices, and materials applicable to the Work.

1.3 SUBMITTAL PROCEDURES

A. Scheduling:

1. Submit for approval, a preliminary schedule of shop drawings and samples submittals, in duplicate, and in accordance with the General Conditions.
2. Prepare and transmit each submittal to ENGINEER sufficiently in advance of scheduled performance of related work and other applicable activities.

B. Coordination:

1. Coordinate preparation and processing of submittals with performance of work. Coordinate each submittal with other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential activity.
2. Coordinate submission of different units of interrelated work so that one submittal will not be delayed by ENGINEER's need to review a related submittal. ENGINEER may withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

C. Submittal Preparation:

1. Stamp and sign each submittal certifying to review of submittal, verification of products, field measurement, field construction criteria, coordination of information within submittal with requirements of the Work and the Contract Documents, coordination with all trades, and verification that product will fit in space provided.
2. Transmittal Form: In the transmittal form forwarding each specific submittal to the ENGINEER include the following information as a minimum.
 - a. Date of submittal and dates of previous submittals containing the same material.
 - b. Project title and number.
 - c. Submittal and transmittal number.

- d. Contract identification.
- e. Names of:
 - (1) Contractor
 - (2) Supplier
 - (3) Manufacturer
- f. Identification of equipment and material with equipment identification numbers, model numbers, and Specification section number.
- g. Variations from Contract Documents and any limitations which may impact the Work.
- h. Drawing sheet and detail number as appropriate.

D. Resubmittal Preparation:

- 1. Comply with the requirements described in Submittal Preparation. In addition:
 - a. Identify on transmittal form that submittal is a resubmission.
 - b. Make any corrections or changes in submittals required by ENGINEER's notations on returned submittal.
 - c. Respond to ENGINEER's notations:
 - (1) On the transmittal or on a separate page attached to CONTRACTOR's resubmission transmittal, answer or acknowledge in writing all notations or questions indicated by ENGINEER on ENGINEER's transmittal form returning review submission to CONTRACTOR.
 - (2) Identify each response by question or notation number established by ENGINEER.
 - (3) If CONTRACTOR does not respond to each notation or question, resubmission will be returned without action by ENGINEER until CONTRACTOR provides a written response to all ENGINEER's notations or questions.
 - d. CONTRACTOR initiated revisions or variations:
 - (1) On transmittal form identify variations or revisions from previously reviewed submittal, other than those called for by ENGINEER.

(2) ENGINEER's responsibility for variations or revisions is established in the General Conditions.

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

- A. Specific submittals required for individual elements of work are specified in the individual Specification sections. Except as otherwise indicated in Specification sections, comply with requirements specified herein for each indicated type of submittal.
- B. Requests for Substitution or "Or Equal"
 - 1. Collect data for items to be submitted for review as substitution into one submittal for each item of material or equipment in accordance with the General Conditions.
 - 2. Submit with other scheduled submittals for the material or equipment allowing time for ENGINEER to evaluate the additional information required to be submitted.
 - 3. If CONTRACTOR requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, schedule substitution submittal request in Submittal schedule and submit as scheduled.
- C. Shop Drawings:
 - 1. Check all drawings, data and samples before submitting to the ENGINEER for review. Each and every copy of the drawings and data shall bear CONTRACTOR's stamp showing that they have been so checked. Shop drawings submitted to the ENGINEER without the CONTRACTOR's stamp will be returned to the CONTRACTOR for conformance with this requirement. All shop drawings shall be submitted through the CONTRACTOR, including those from any subcontractors.
 - 2. Submit newly prepared information, with graphic information at accurate scale. Indicate name of manufacturer or supplier (firm name). Show dimensions and clearly note which are based on field measurement; identify materials and products which are included in the Work; identify revisions. Indicate compliance with standards and notation of coordination requirements with other work. Highlight, encircle or otherwise indicate variations from Contract Documents or previous submittals.
 - 3. Include on each drawing or page:

- a. Submittal date and revision dates.
 - b. Project name, division number and descriptions.
 - c. Detailed specifications section number and page number.
 - d. Identification of equipment, product or material.
 - e. Name of CONTRACTOR and Subcontractor.
 - f. Name of Supplier and Manufacturer.
 - g. Relation to adjacent structure or material.
 - h. Field dimensions, clearly identified.
 - i. Standards or Industry Specification references.
 - j. Identification of deviations from the Contract Documents.
 - k. CONTRACTOR's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.
 - l. Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.
4. Provide 8-inch by 3-inch blank space for CONTRACTOR and ENGINEER stamps.
 5. Submittals:
 - a. Submit 3 hard copies plus 1 PDF.
 6. Distribution:
 - a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approved information is in possession of installer.
 - b. Maintain one set of product data (for each submittal) at Project site.
 - c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER's records.

D. Product Data:

1. Preparation:
 - a. Collect required data into single submittal for each element of work or system. Where product data has been printed to include information on several similar products, some of which are not required for use on Project or are not included in submittal, mark copies to clearly show such information is not applicable.
 - b. Where product data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, submit data as a Shop Drawing and not as product data.
2. Submittals:
 - a. Submittal is for information and record, and to determine that products, materials, and systems comply with Contract Documents. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".
 - b. Submit 3 copies.
3. Distribution:
 - a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approval information is in possession of installer.
 - b. Maintain one set of product data (for each submittal) at Project site, available for reference by ENGINEER and others.
 - c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER records.

E. Samples:

1. Preparation:
 - a. Where possible, provide samples that are physically identical with proposed materials or products to be incorporated into the Work. Where variations in color, pattern or texture are inherent in material or product represented by sample, submit multiple units (not less than 3 units) showing approximate limits of variations.

- b. Provide full set of optional samples where ENGINEER's selection required. Prepare samples to match ENGINEER's selection where so indicated.
- c. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards.
- d. Submit samples for ENGINEER's visual review of general generic kind, color, pattern, texture, and for final check of coordination of these characteristics with other related elements of work.

2. Submittals:

- a. At CONTRACTOR's option, and depending upon nature of anticipated response from ENGINEER, initial submittal of samples may be either preliminary or final submittal.
- b. A preliminary submittal, consisting of a single set of samples, is required where specifications indicate ENGINEER's selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary. Preliminary submittals will be reviewed and returned with ENGINEER's "Action" marking.
- c. Final Submittals: Submit 3 sets of samples in final submittal, 1 set will be returned.

3. Distribution:

- a. Maintain returned final set of samples at Project site, in suitable condition and available for quality control comparisons throughout course of performing work.
- b. Returned samples intended or permitted to be incorporated in the Work are indicated in Specification sections and shall be in undamaged condition at time of use.

F. Mock-Ups:

- 1. Mock-ups and similar samples specified in Specification sections are recognized as special type of samples. Comply with samples submittal requirements to greatest extent possible. Process transmittal forms to provide record of activity.

G. Miscellaneous Submittals:

1. Inspection and Test Reports:
 - a. Classify each inspection and test report as being either "Shop Drawings" or "product data", depending on whether report is specially prepared for Project or standard publication of workmanship control testing at point of production. Process inspection and test reports accordingly.
2. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds:
 - a. Refer to Specification sections for specific requirements. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".
 - b. In addition to copies desired for CONTRACTOR's use, furnish 2 executed copies. Provide 2 additional copies where required for maintenance data.
3. Survey Data:
 - a. Refer to Specification sections for specific requirements on property surveys, building or structure condition surveys, field measurements, quantitative records of actual Work, damage surveys, photographs, and similar data required by Specification sections. Copies will not be returned.
 - (1) Survey Copies: Furnish 2 copies. Provide 10 copies of final property survey (if any).
 - (2) Condition Surveys: Furnish 2 copies.
4. Certifications:
 - a. Refer to Specification sections for specific requirement on submittal of certifications. Submit 7 copies. Certifications are submitted for review of conformance with specified requirements and information. Submittal is final when returned by ENGINEER marked "Approved".
5. Closeout Submittals:
 - a. Refer to Specification Section 01 77 00 for specific requirements on submittal of closeout information, materials, tools, and similar items.
 - (1) Record Documents: Section 01 77 00.

(2) Materials and Tools: Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

(3) Operating and maintenance data.

H. Operation and Maintenance Manuals:

1. Submit Operation and Maintenance Manuals in accordance with Section 01 78 23.

I. General Distribution:

1. Unless required elsewhere, provide distribution of submittals to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of work.

1.5 ACTION ON SUBMITTALS

A. ENGINEER's Action:

1. General:

a. Except for submittals for record and similar purposes, where action and return on submittals are required or requested, ENGINEER will review each submittal, mark with appropriate action, and return. Where submittal must be held for coordination, ENGINEER will also advise CONTRACTOR without delay.

b. ENGINEER will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.

B. Action Stamp:

1. Approved:

a. Final Unrestricted Release: Where submittals are marked "Approved", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.

2. Approved As Noted:

a. When submittals are marked "Approved as Noted", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH BOTH ENGINEER'S NOTATIONS OR CORRECTIONS ON SUBMITTAL

AND WITH Contract Documents. Acceptance of Work will depend on that compliance. Re-submittal is not required.

3. Comments Attached - Confirm or Resubmit:
 - a. When submittals are marked "Examined and Returned for Correction", do not proceed with Work covered by submittal. Do not permit Work covered by submittal to be used at Project site or elsewhere where Work is in progress.
 - b. Revise submittal or prepare new submittal in accordance with ENGINEER's notations in accordance with Paragraph 1.3D of this section. Resubmit submittal without delay. Repeat if necessary to obtain different action marking.

1.6 RE-SUBMITTAL REVIEW

- A. Cost of Subsequent Reviews: Shop Drawings and Operation and Maintenance Manuals submitted for each item will be reviewed no more than twice at the OWNER's expense. All subsequent reviews will be performed at times convenient to the ENGINEER and at the CONTRACTOR's expense based on the ENGINEER's then prevailing rates including all direct and indirect costs and fees. Reimburse the OWNER for all such fees invoiced to the OWNER by the ENGINEER.
- B. Time Extension: Any need for more than one resubmission, or any other delay in ENGINEER's review of submittals, will not entitle CONTRACTOR to extension of the Contract Time.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 42 00
REFERENCE STANDARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Abbreviations and Symbols
- B. Reference Standards
- C. Definitions

1.2 RELATED SECTIONS

- A. Information provided in this section is used where applicable in individual Specification Sections, Divisions 2 through 16.

1.3 REFERENCE ABBREVIATIONS

- A. Reference to a technical society, trade association or standards setting organization, may be made in the Specifications by abbreviations in accordance with the following list:

AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
ADC	Air Diffusion Council
AFBMA	Anti-friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHA	Association of Home Appliance Manufacturers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	American Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers

ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders' Hardware Manufacturers Association
BIA	Brick Institute of American
CABO	Council of American Building Officials
CAGI	Compressed Air and Gas Institute
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers Association of America
CRD	U.S. Corps of Engineers Specifications
CRSI	Concrete Reinforcing Steel Institute
CTI	Cooling Tower Institute
DHI	Door and Hardware Institute
DOH	Department of Health
DOT	Department of Transportation
Fed. Spec.	Federal Specifications
FGMA	Flat Glass Marketing Association
FM	Factory Mutual
HMI	Hoist Manufacturing Institute
HPMA	See HPVA
HPVA	Hardwood Plywood Veneer Association
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IFI	Industrial Fasteners Institute
MIL	Military Specifications
MSS	Manufacturer's Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NACM	National Association of Chain Manufacturers
NBS	National Bureau of Standards, See NIST
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NETA	National Electrical Testing Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NFPA	National Fluid Power Association
NIST	National Institute of Standards and Technology
NLMA	National Lumber Manufacturers Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Act
PCI	Prestressed Concrete Institute

PDI	Plumbing and Drainage Institute
SAE	Society of Automotive Engineers
SCPRF	Structural Clay Products Research Foundation
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPI	Society of the Plastics Industry
SSPC	Steel Structures Painting Council
STI	Steel Tank Institute
TCA	Tile Council of American
TIMA	Thermal Insulation Manufacturers' Association
UL	Underwriters' Laboratories, Inc.
USBR	U. S. Bureau of Reclamation
USBS	U. S. Bureau of Standards, See NIST

1.4 REFERENCE STANDARDS

- A. Latest Edition: Construe references to furnishing materials or testing, which conform to the standards of a particular technical society, organization, or body, to mean the latest standard, code, or specification of that body, adopted and published as of the date of bidding this Contract. Standards referred to herein are made a part of these Specifications to the extent which is indicated or intended.
- B. Precedence: The duties and responsibilities of the OWNER, CONTRACTOR or ENGINEER, or any of their consultants, agents or employees are set forth in the Contract Documents and are not changed or altered by any provision of any referenced standard specifications, manuals or code, whether such standard manual or code is or is not specifically incorporated by reference in the Contract Documents. Any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority, to undertake responsibility contrary to the powers of the ENGINEER as set forth in the Contract Documents cannot be assigned to the ENGINEER or any of the ENGINEER's consultants, agents or employees.

1.5 DEFINITIONS

- A. In these Contract Documents the words furnish, install and provide are defined as follows:
 - 1. Furnish (Materials): to supply and deliver to the project ready for installation and in operable condition.
 - 2. Install (services or labor): to place in final position, complete, anchored, connected in operable condition.

3. Provide: to furnish and install complete. Includes the supply of specified services. When neither furnish, install or provide is stated, provided is implied.

1.6 LCU APPROVED MATERIALS LIST

- A. The CONTRACTOR shall refer to the most recent Approved Materials List, as of the date of the advertisement for these contract documents.
- B. The Approved Materials List located on LCU website constitutes a part of these contract documents.

1.7 LCU STANDARD DETAILS

- A. The CONTRACTOR shall refer to the most recent LCU Standard Details, as of the date of the advertisement for these contract documents.
- B. The Standard Details located on LCU website constitutes a part of these contract documents.

1.8 LCU DESIGN MANUAL

- A. The CONTRACTOR shall refer to the most recent LCU Design Manual, as of the date of the advertisement for these contract documents.
- B. The Design Manual located on LCU website constitutes a part of these contract documents.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 42 13

ABBREVIATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Abbreviations
- B. Standards for Abbreviations

1.2 RELATED SECTIONS

- A. Abbreviations provided in this section are used where applicable in individual Specification Sections, Divisions 2 through 16.

1.3 ABBREVIATIONS

- A. Abbreviations which may be used in Divisions 1 through 16 for units of measure are as follows:

alternating current	ac	coefficient, valve flow.....	C _v
American wire gauge.....	AWG	cubic	cu
ampere(s).....	amp	cubic centimeter(s)	cc
ampere-hour(s)	AH	cubic feet per day	cfh
annual	ann	cubic feet per hour.....	cfh
Ampere Interrupting		cubic feet per minute	cfm
Capacity	AIC	cubic feet per minute,	
atmosphere(s).....	atm	standard conditions	scfm
average	avg	cubic feet per second	cfs
		cubic foot (feet).....	cu ft
biochemical oxygen demand.....	BOD	cubic inch(es)	cu in
Board Foot	FBM	cubic yard(s).....	cu yd
brake horsepower	bhp		
Brinell Hardness.....	BH	decibels	dB
British thermal unit(s)	Btu	decibels (A scale)	dBa
		degree(s).....	deg
calorie (s)	cal	dewpoint temperature.....	dpt
carbonaceous biochemical		diameter.....	dia
oxygen demand.....	CBOD	direct current.....	dc
Celsius (centigrade)	C	dissolved oxygen.....	DO
Center to Center.....	C to C	dissolved solids	DS
centimeter(s)	cm	dry-bulb temperature	dbt
chemical oxygen demand.....	COD		

efficiency eff
 elevation el
 entering water temperature ewt
 entering air temperature eat
 equivalent direct radiation edr

 face area fa
 face to face f to f
 Fahrenheit F
 feet per day fpd
 feet per hour fph
 feet per minute fpm
 feet per second fps
 foot (feet) ft
 foot-candle fc
 foot-pound ft-lb
 foot-pounds per minute ft-lb/min
 foot-pounds per second ft-lb/sec
 formazin turbidity unit(s) FTU
 frequency freq

 gallon(s) gal
 gallons per day gpd
 gallons per day per
 cubic foot gpd/cu ft
 gallons per day per
 square foot gpd/sq ft
 gallons per hour gph
 gallons per minute gpm
 gallons per second gps
 gas chromatography and
 mass spectrometry GC-MS
 gauge ga
 grain(s) gr
 gram(s) g
 grams per cubic centimeter gm/cc

 Heat Transfer Coefficient U
 height hgt
 Hertz Hz
 horsepower hp
 horsepower-hour hp-hr
 hour(s) hr
 humidity, relative rh
 hydrogen ion concentration pH

inch(es) in
 inches per second ips
 inside diameter ID

 Jackson turbidity unit(s) JTU

 kelvin K
 kiloamperes kA
 kilogram(s) kg
 kilometer(s) km
 kilovar (kilovolt-amperes
 reactive) kvar
 kilovolt(s) kV
 kilovolt-ampere(s) kVA
 kilowatt(s) kW
 kilowatt-hour(s) kWh

 linear foot (feet) lin ft
 liter(s) L

 megavolt-ampere(s) MVA
 meter(s) m
 micrograms per liter ug/L
 miles per hour mph
 milliamperes(s) mA
 milligram(s) mg
 milligrams per liter mg/L
 milliliter(s) mL
 millimeter(s) mm
 million gallons MG
 million gallons per day mgd
 millisecond(s) ms
 millivolt(s) mV
 minute(s) min

 mixed liquor suspended
 solids MLSS

 nephelometric turbidity
 unit NTU
 net positive suction head NPSH
 noise criteria nc
 noise reduction coefficient NRC
 number no

 ounce(s) oz

outside air..... oa
 outside diameter.....OD

 parts per billion..... ppb
 parts per million..... ppm
 percent..... pct
 phase (electrical)..... . . ph
 pound(s)..... lb
 pounds per cubic foot..... pcf
 pounds per cubic foot
 per hour..... pcf/hr
 pounds per daylbs/day
 pounds per day per
 cubic foot..... lbs/day/cu ft
 pounds per day per
 square foot lbs/day/sq ft
 pounds per square foot psf
 pounds per square foot
 per hour..... psf/hr
 pounds per square inch..... psi
 pounds per square inch
 absolute..... psia
 pounds per square inch
 gauge psig
 power factor PF
 pressure drop or
 difference dp
 pressure, dynamic
 (velocity)..... vp
 pressure, vapor vap pr

 quart(s)..... qt

 Rankine R
 relative humidity rh
 resistance..... res
 return air..... ra
 revolution(s) rev
 revolutions per minute rpm
 revolutions per second rps
 root mean squared rms

 safety factor..... sf
 second(s) sec
 shading coefficient..... SC
 sludge density index..... SDI

Sound Transmission

Coefficient..... STC
 specific gravity sp gr
 specific volume Sp Vol
 sp ht at constant pressure Cp
 square sq
 square centimeter(s)..... sq cm
 square foot (feet) sq ft
 square inch (es)..... sq in
 square meter(s) sq m
 square yard(s) sq yd
 standard..... std
 static pressure st pr
 supply air sa
 suspended solids..... SS

 temperature temp
 temperature difference TD
 temperature entering TE
 temperature leaving..... TL
 thousand Btu per hour Mbh
 thousand circular mils..... kcmil
 thousand cubic feet Mcf
 threshold limit value..... TLV
 tons of refrigeration..... tons
 torque TRQ
 total dissolved solids..... TDS
 total dynamic head TDH
 total kjeldahl nitrogen..... TKN
 total oxygen demand TOD
 total pressure..... TP
 total solids..... TS
 total suspended solids TSS
 total volatile solids TVS

 vacuum..... vac
 viscosity visc
 volatile organic chemical VOC
 volatile solids VS
 volatile suspended solids..... VSS
 volt(s)..... V
 volts-ampere(s)..... VA
 volume vol

 watt(s)..... W

watthour(s) Wh
watt-hour demand WHD
watt-hour demand meterWHDM
week(s)..... wk
weight..... wt

wet-bulb WB
wet bulb temperature WBT
yard(s) yd
year(s) yr

1.4 STANDARD FOR ABBREVIATIONS

- A. Use ASME Y1.1-1989, "Abbreviations for use on Drawings and in Text" for abbreviations for units of measure not included in Paragraph 1.3.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 43 00
QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittals
- B. Inspection Services
- C. Inspection of Materials
- D. Quality Control
- E. Costs of Inspection
- F. Acceptance Tests
- G. Failure to Comply with Contract

1.2 RELATED SECTIONS

- A. Section 01 33 00 - Submittals: Specific Submittal Requirements

1.3 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. Certificate Submittals: Furnish the ENGINEER authoritative evidence in the form of Certificates of Manufacture that the materials and equipment to be used in the Work have been manufactured and tested in conformity with the Contract Documents. Include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

1.4 INSPECTION SERVICES

- A. OWNER's Access: At all times during the progress of the Work and until the date of final completion, afford the OWNER and ENGINEER every reasonable, safe, and proper facility for inspecting the Work at the site. The observation and inspection of any work will not relieve the CONTRACTOR of any obligations to perform proper and satisfactory work as specified. Replace work rejected due to faulty design, inferior, or defective materials, poor workmanship, improper

installation, excessive wear, or nonconformity with the requirements of the Contract Documents, with satisfactory work at no additional cost to the OWNER. Replace as directed, finished or unfinished work found not to be in strict accordance with the Contract, even though such work may have been previously approved, and payment made therefor.

- B. Rejection: The OWNER and the OWNER's Authorized Representatives have the right to reject materials and workmanship which are defective or require correction. Promptly remove rejected work and materials from the site.
- C. Inferior Work Discoveries: Failure or neglect on the part of the OWNER or the OWNER's Authorized Representatives to condemn or reject bad or inferior work or materials does not imply an acceptance of such work or materials. Neither is it to be construed as barring the OWNER or the OWNER's Authorized Representatives at any subsequent time from recovering damages or a sum of money needed to build anew all portions of the Work in which inferior work or improper materials were used.
- D. Removal for Examination: Should it be considered necessary or advisable by the OWNER or the OWNER's Authorized Representatives, at any time before final acceptance of the Work, to make examinations of portions of the Work already completed, by removing or tearing out such portions, promptly furnish all necessary facilities, labor, and material, to make such an examination. If such Work is found to be defective in any respect, defray all expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the cost of examination and restoration of the Work will be considered a change in the Work to be paid for in accordance with applicable provisions of the Contract.
- E. Operation Responsibility: Assume full responsibility for the proper operation of equipment during tests and instruction periods. Make no claim for damage which may occur to equipment prior to the time when the OWNER accepts the Work.
- F. Rejection Prior to Warranty Expiration: If at anytime prior to the expiration of any applicable warranties or guarantees, equipment is rejected by the OWNER, repay to the OWNER all sums of money received for the rejected equipment on progress certificates or otherwise on account of the Contract lump sum prices, and upon the receipt of the sum of money, OWNER will execute and deliver a bill of sale of all its rights, title, and interest in and to the rejected equipment. Do not remove the equipment from the premises of the OWNER until the OWNER obtains from other sources, equipment to take the place of that rejected. The OWNER hereby agrees to obtain other equipment within a reasonable time and the CONTRACTOR agrees that the OWNER may use the equipment furnished by the CONTRACTOR without rental or other charge until the other new equipment is obtained.

1.5 INSPECTION OF MATERIALS

- A. Premanufacture Notification: Give notice in writing to the ENGINEER sufficiently in advance of the commencement of manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. When required, notice to include 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, ENGINEER will arrange to have a representative present at such times during the manufacture or testing as may be necessary to inspect the materials or will notify CONTRACTOR that the inspection will be made at a point other than the point of manufacture or testing, or that the inspection will be waived. Comply with these provisions before shipping any materials. Such inspection will not constitute a release from the responsibility for furnishing materials meeting the requirements of the Contract Documents.
- B. Testing Standards: Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized, applicable test codes except as may otherwise be stated herein.

1.6 QUALITY CONTROL

A. Testing

1. Field and Laboratory

- a. Provide personnel to assist the ENGINEER in performing the following periodic observation and associated services.
 - (1) Soils: Observe and test excavations, placement and compaction of soils. Determine suitability of excavated material. Observe subgrade soils and foundations.
 - (2) Concrete: Observe forms and reinforcement; observe concrete placement; witness air entrainment tests, facilitate concrete cylinder preparation and assist with other tests performed by ENGINEER.
 - (3) Masonry: Sample and test mortar, bricks, blocks and grout; inspect brick and block samples and sample panels; inspect placement of reinforcement and grouting.
- b. When specified in Divisions 2 through 16 of the Contract Documents, provide an independent laboratory testing facility to perform required testing. Qualify the laboratory as having performed previous satisfactory work. Prior to use, submit to the ENGINEER for approval.

- c. Cooperate with the ENGINEER and laboratory testing representatives. Provide at least 24 hours notice prior to when specified testing is required. Provide labor and materials, and necessary facilities at the site as required by the ENGINEER and the testing laboratory.
 - d. Provide an independent testing agency, a member of the National Electrical Testing Association, to perform inspections and tests specified in Division 16 of these Specifications.
2. Equipment: Coordinate and demonstrate test procedures as specified in the Contract Documents or as otherwise required during the formal tests.
 3. Pipeline and Other Testing: Conform to test procedures and requirements specified in the appropriate Specification Section.

B. Reports

1. Certified Test Reports: Where transcripts or certified test reports are required by the Contract Documents, meet the following requirements:
 - a. Before delivery of materials or equipment submit and obtain approval of the ENGINEER for all required transcripts, certified test reports, certified copies of the reports of all tests required in referenced specifications or specified in the Contract Documents. Perform all testing in an approved independent laboratory or the manufacturer's laboratory. Submit for approval reports of shop equipment tests within thirty days of testing. Transcripts or test reports are to be accompanied by a notarized certificate in the form of a letter from the manufacturer or supplier certifying that tested material or equipment meets the specified requirements and the same type, quality, manufacture and make as specified. The certificate shall be signed by an officer of the manufacturer or the manufacturer's plant manager.
2. Certificate of Compliance: At the option of the ENGINEER, or where not otherwise specified, submit for approval a notarized Certificate of Compliance. The Certificates may be in the form of a letter stating the following:
 - a. Manufacturer has performed all required tests
 - b. Materials to be supplied meet all test requirements
 - c. Tests were performed not more than one year prior to submittal of the certificate

- d. Materials and equipment subjected to the tests are of the same quality, manufacture and make as those specified
- e. Identification of the materials

1.7 COSTS OF INSPECTION

- A. OWNER's Obligation: Initial inspection and testing of materials furnished under this Contract will be performed by the OWNER or his authorized Representatives or inspection bureaus without cost to the CONTRACTOR, unless otherwise expressly specified. If subsequent testing is necessary due to failure of the initial tests or because of rejection for noncompliance, reimburse the OWNER for expenditures incurred in making such tests.
- B. CONTRACTOR's Obligation: Include in the Contract Price, the cost of all shop and field tests of equipment and other tests specifically called for in the Contract Documents.
- C. Reimbursements to OWNER:
 - 1. Materials and equipment submitted by the CONTRACTOR as the equivalent to those specifically named in the Contract may be tested by the OWNER for compliance. Reimburse the OWNER for expenditures incurred in making such tests on materials and equipment which are rejected for noncompliance.
 - 2. Reimburse OWNER for the costs of any jobsite inspection between the hours of 7:00 p.m. and 6:00 a.m.
 - 3. Reimburse OWNER for all costs associated with Witness Tests which exceed 5 Calendar Days per kind of equipment.

1.8 ACCEPTANCE TESTS

- A. Preliminary Field Tests: As soon as conditions permit, furnish all labor and materials and services to perform preliminary field tests of all equipment provided under this Contract. If the preliminary field tests disclose that any equipment furnished and installed under this Contract does not meet the requirements of the Contract Documents, make all changes, adjustments and replacements required prior to the acceptance tests.
- B. Final Field Tests: Upon completion of the Work and prior to final payment, subject all equipment, piping and appliances installed under this Contract to specified acceptance tests to demonstrate compliance with the Contract Documents.

1. Furnish all labor, fuel, energy, water and other materials, equipment, instruments and services necessary for all acceptance tests.
 2. Conduct field tests in the presence of the ENGINEER. Perform the field tests to demonstrate that under all conditions of operation each equipment item:
 - a. Has not been damaged by transportation or installation
 - b. Has been properly installed
 - c. Has been properly lubricated
 - d. Has no electrical or mechanical defects
 - e. Is in proper alignment
 - f. Has been properly connected
 - g. Is free of overheating of any parts
 - h. Is free of all objectionable vibration
 - i. Is free of overloading of any parts
 - j. Operates as intended
 3. Operate work or portions of work for a minimum of 100 hours or 14 days continuous service, whichever comes first. For those items of equipment which would normally operate on wastewater or sludge, plant effluent may be used if available when authorized by ENGINEER. If water can not properly exercise equipment, conduct 100-hour test after plant startup. Conduct test on those systems which require load produced by weather (heating or cooling) exercise only when weather will produce proper load.
- C. Failure of Tests: If the acceptance tests reveal defects in material or equipment, or if the material or equipment in any way fails to comply with the requirements of the Contract Documents, then promptly correct such deficiencies. Failure or refusal to correct the deficiencies, or if the improved materials or equipment, when tested again, fail to meet the guarantees or specified requirements, the OWNER, notwithstanding its partial payment for work and materials or equipment, may reject said materials or equipment and may order the CONTRACTOR to remove the defective work from the site at no addition to the Contract Price, and replace it with material or equipment which meets the Contract Documents.

1.9 FAILURE TO COMPLY WITH CONTRACT

- A. Unacceptable Materials: If it is ascertained by testing or inspection that the material or equipment does not comply with the Contract, do not deliver said material or equipment, or if delivered remove it promptly from the site or from the Work and replace it with acceptable material without additional cost to the OWNER. Fulfill all obligations under the terms and conditions of the Contract even though the OWNER or the OWNER's Authorized Representatives fail to ascertain noncompliance or notify the CONTRACTOR of noncompliance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 55 26
TRAFFIC REGULATION

PART 1 GENERAL

1.1 SECTION INCLUDES:

- A. General Requirements
- B. Traffic Control

1.2 RELATED SECTIONS

- A. Section 33 05 02 – Roadway Crossings by Open Cut

1.3 GENERAL REQUIREMENTS

- A. All projects and work on highways, roads, and streets, shall have a traffic control plan (TCP), as required by Florida Statute and Federal regulations. All work shall be executed under the established plan and Department approved procedures. The TCP is the result of considerations and investigations made in the development of a comprehensive plan for accommodating vehicular and pedestrian traffic through the construction zone.
- B. The complexity of the TCP varies with the complexity of the traffic problems associated with a project. Many situations can be covered adequately with reference to specific sections from the Manual on Uniform Traffic Control Devices (MUTCD), the Traffic Control Devices Handbook (TCDH), or Roadway and Traffic Design Standard Series 600.
- C. The CONTRACTOR shall be responsible for providing safe and expeditious movement of traffic through construction zones. A construction zone is defined as the immediate areas of actual construction and all abutting areas which are used by the CONTRACTOR, and which interfere with the driving or walking public.
- D. Remove temporary equipment and facilities when no longer required, restore grounds to original, or to specified conditions.
- E. The requirements specified herein are in addition to the plan for Maintenance of Traffic as specified in Section 33 05 02.
- F. Before starting work, the CONTRACTOR shall submit to the Lee County Department of Transportation, with copy to the ENGINEER, a detailed schedule

of his operations a minimum of fourteen (14) days prior to beginning work for approval. This shall include, but not be limited to, type and extent of temporary paving, and drawings and lists describing materials and traffic control methods to be used. Approval shall not relieve the CONTRACTOR of his obligation to provide a safe and proper crossing.

1.4 TRAFFIC CONTROL

- A. The necessary precautions shall include, but not be limited to, such items as proper construction warning signs, signals, lighting devices, marking, barricades, channelization, and hand signaling devices. The CONTRACTOR shall be responsible for installation and maintenance of all devices and requirements for the duration of the Construction period.
- B. The CONTRACTOR shall provide at least 72 hours notification to the State, County, or municipal Department of Transportation of the necessity to close any portion of a roadway carrying vehicles or pedestrians so that the final approval of such closings can be obtained at least 48 hours in advanced. At no time will more than one (1) lane of roadway be closed to vehicles and pedestrians. With any such closings adequate provision shall be made for the safe expeditious movement of each.
- C. The CONTRACTOR shall also be responsible for notifying Police, Fire, and other Emergency Departments whenever construction is within roadways and of the alternate routes. Monthly status reports shall be provided to these Departments, as a minimum.
- D. The CONTRACTOR shall be responsible for removal, relocation, or replacement of any traffic control device in the construction area which exists as part of the normal pre-construction traffic control scheme. Any such actions shall be performed by the CONTRACTOR under the supervision, and in accordance with the Specifications, of the Owner, unless otherwise specified.
- E. The CONTRACTOR shall immediately notify the Owner of any vehicular or pedestrian safety or efficiency problems incurred as a result of the construction of the project.
- F. The CONTRACTOR shall be responsible for notifying all residents of any road construction and limited access at least 72 hours in advance.

PART 2 PRODUCTS

NOT USED.

PART 3 EXECUTION

NOT USED.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 57 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General Requirements
- B. Temporary Utilities
- C. Temporary Construction
- D. Barricades and Enclosures
- E. Fences
- F. Security
- G. Temporary Controls
- H. Traffic Regulation
- I. Field Offices and Sheds

1.2 GENERAL REQUIREMENTS

- A. Plant and Facilities: Furnish, install, maintain and remove all false work, scaffolding, ladders, hoist ways, braces, pumping plants, shields, trestles, roadways, sheeting, centering forms, barricades, drains, flumes, and the like, any of which may be needed in the construction of any part of the Work and which are not herein described or specified in detail. The CONTRACTOR shall accept responsibility for the safety and efficiency of such works and for any damage that may result from their failure or from their improper construction, maintenance or operation.
- B. First Aid: Maintain a readily accessible, completely equipped first aid kit at each location where work is in progress.
- C. Safety Responsibility: Accept sole responsibility for safety and security at the site. Indemnify and hold harmless the OWNER and the OWNER's Authorized Representatives, including the ENGINEER, for any safety violation, or noncompliance with governing bodies and their regulations, and for accidents,

deaths, injuries, or damage at the site during occupancy or partial occupancy of the site by CONTRACTOR's forces while performing any part of the Work.

- D. Hazard Communication: Furnish two copies of the CONTRACTOR's Hazard Communication Program required under OSHA regulations before beginning on site activities. Furnish two copies of amendments to Hazard Communications Program as they are prepared.

1.3 TEMPORARY UTILITIES

- A. Water: Provide all necessary and required water without additional cost, unless otherwise specified. If necessary, provide and lay water lines to the place of use; secure all necessary permits; pay for all taps to water mains and hydrants and for all water used at the established rates.
- B. Light and Power: Provide without additional cost to the OWNER temporary lighting and power facilities required for the proper construction and inspection of the Work. If, in the ENGINEER's opinion, these facilities are inadequate, do NOT proceed with any portion of the Work affected thereby. Maintain temporary lighting and power until the Work is accepted.
- C. Heat: Provide temporary heat, whenever required, for work being performed during cold weather to prevent freezing of concrete, water pipes, and other damage to the Work or existing facilities.
- D. Sanitary Facilities: Provide sufficient sanitary facilities for construction personnel. Prohibit and prevent nuisances on the site of the Work or on adjoining property. Discharge any employee who violates this rule. Abide by all environmental regulations or laws applicable to the Work.
- E. Connections to Existing Utilities:
 - 1. Unless otherwise specified or indicated, make all necessary connections to existing facilities including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electricity. In each case, obtain permission from the OWNER or the owning utility prior to undertaking connections. Protect facilities against deleterious substances and damage.
 - 2. Thoroughly plan in advance all connections to existing facilities. Have on hand at the time of undertaking the connections, all material, labor and required equipment. Proceed continuously to complete connections in minimum time. Arrange for the operation of valves or other appurtenances on existing utilities, under the direct supervision of the owning utility.

1.4 TEMPORARY CONSTRUCTION

- A. Bridges: Design and place suitable temporary bridges where necessary for the maintenance of vehicular and pedestrian traffic. Assume responsibility for the sufficiency and safety of all such temporary work or bridges and for any damage which may result from their failure or their improper construction, maintenance, or operation. Indemnify and save harmless the OWNER and the OWNER's representatives from all claims, suits or actions, and damages or costs of every description arising by reason of failure to comply with the above provisions.

1.5 BARRICADES AND ENCLOSURES

- A. Protection of Workmen and Public: Effect and maintain at all times during the prosecution of the Work, barriers and lights necessary for the protection of Workmen and the Public. Provide suitable barricades, lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the Work causes obstructions to normal traffic, excavation sites, or constitutes in any way a hazard to the public.

- B. Barricades and Lights:

- 1. Protect all streets, roads, highways, excavations and other public thoroughfares which are closed to traffic; use effective barricades which display acceptable warning signs. Locate barricades at the nearest public highway or street on each side of the blocked section.
- 2. Statutory Requirements: Install and maintain all barricades, signs, lights, and other protective devices within highway rights-of-way in strict conformity with applicable statutory requirements by the authority having jurisdiction.

1.6 FENCES

- A. Existing Fences: Obtain written permission from the OWNER prior to relocating or dismantling fences which interfere with construction operations. Reach agreements with the fence owner as to the period the fence may be left relocated or dismantled. Install adequate gates where fencing must be maintained. Keep gates closed and locked at all times when not in use.
- B. Restoration: Restore all fences to their original or better condition and to their original location on completion of the Work.

1.7 SECURITY

- A. Preservation of Property:

1. Preserve from damage, all property along the line of the Work, in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Preserve from damage, public utilities, trees, lawn areas, building monuments, fences, pipe and underground structures, and public streets. Note: Normal wear and tear of streets resulting from legitimate use by the CONTRACTOR are not considered as damage. Whenever damages occur to such property, immediately restore to its original condition. Costs for such repairs are incidental to the Contract.
2. In case of failure on the part of the CONTRACTOR to restore property or make good on damage or injury, the OWNER may, upon 24 hours written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any moneys due or which may become due the CONTRACTOR under this Contract. If removal, repair or replacement of public or private property is made necessary by alteration of grade or alignment authorized by the OWNER and not contemplated by the Contract Documents, the CONTRACTOR will be compensated, in accordance with the General Conditions, provided that such property has not been damaged through fault of the CONTRACTOR or the CONTRACTOR's employees.

B. Public Utility Installations and Structures:

1. Public utility installations and structures include all poles, tracks, pipes, wires, conduits, vaults, manholes, and other appurtenances and facilities, whether owned or controlled by public bodies or privately-owned individuals, firms or corporations, used to serve the public with transportation, gas, electricity, telephone, storm and sanitary sewers, water, or other public or private utility services. Facilities appurtenant to public or private property which may be affected by the Work are deemed included hereunder.
2. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. Existing public utility installations and structures are indicated on the Drawings only to the extent such information was made available to, or found by, the ENGINEER in preparing the Drawings. These data are not guaranteed for completeness or accuracy, and the CONTRACTOR is responsible for making necessary investigations to become fully informed as to the character, condition, and extent of all public utility installations and structures that may be encountered and that may affect the construction operations.
3. Contact utility locating service sufficiently in advance of the start of construction to avoid damage to the utilities and delays to the completion date.

4. Remove, replace, relocate, repair, rebuild, and secure any public utility installations and structures damaged as a direct or indirect result of the Work under this Contract. Costs for such work are incidental to the Contract. Be responsible and liable for any consequential damages done to or suffered by any public utility installations or structures. Assume and accept responsibility for any injury, damage, or loss which may result from or be consequent to interference with, or interruption or discontinuance of, any public utility service.
5. Repair or replace any water, electric, sewer, gas, irrigation, or other service connection damaged during the Work with no addition to the Contract price.
6. At all times in performance of the Work, employ proven methods and exercise reasonable care and skill to avoid unnecessary delay, injury, damage, or destruction to public utility installations and structures. Avoid unnecessary interference with, or interruption of, public utility services. Cooperate fully with the owners thereof to that end.
7. Give written notice to the owners of all public utility installations and structures affected by proposed construction operations, sufficiently in advance of breaking ground in any area or on any unit of the Work, to obtain their permission before disrupting the lines and to allow them to take measures necessary to protect their interests. Advise the Chiefs of Police, Fire and Rescue Services of any excavation in public streets or the temporary shut-off of any water main. Provide at least 24 hours notice to all affected property owners whenever service connections are taken out of service.

C. Work on Private Property:

Not used.

- D. Miscellaneous Structures: Assume and accept responsibility for all injuries or damage to culverts, building foundations and walls, retaining walls, or other structures of any kind met with during the prosecution of the Work. Assume and accept liability for damages to public or private property resulting therefrom. Adequately protect against freezing all pipes carrying liquid.

E. Protection of Trees and Lawn Areas:

1. Protect with boxes, trees and shrubs, except those ordered to be removed. Do not place excavated material so as to cause injury to such trees or shrubs. Replace trees or shrubs destroyed by accident or negligence of the CONTRACTOR or CONTRACTOR's employees with new stock of similar size and age, at the proper season, at no additional cost to the OWNER.

2. Leave lawn areas in as good condition as before the start of the Work. Restore areas where sod has been removed by seeding or sodding.

1.8 TEMPORARY CONTROLS

A. During Construction:

1. Keep the site of the Work and adjacent premises free from construction materials, debris, and rubbish. Remove this material from any portion of the site if such material, debris, or rubbish constitutes a nuisance or is objectionable.
2. Remove from the site all surplus materials and temporary structures when they are no longer needed.
3. Neatly stack construction materials such as concrete forms and scaffolding when not in use. Promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.
4. Properly store volatile wastes in covered metal containers and remove from the site daily.
5. Do not bury or burn on the site or dispose of into storm drains, sanitary sewers, streams, or waterways, any waste material. Remove all wastes from the site and dispose of in a manner complying with applicable ordinances and laws.

B. Smoke Prevention:

1. Strictly observe all air pollution control regulations.
2. Open fires will be allowed only if permitted under current ordinances.

C. Noises:

1. Maintain acceptable noise levels in the vicinity of the Work. Limit noise production to acceptable levels by using special mufflers, barriers, enclosures, equipment positioning, and other approved methods.
2. Supply written notification to the OWNER sufficiently in advance of the start of any work which violates this provision. Proceed only when all applicable authorizations and variances have been obtained in writing.

D. Hours of Operation:

1. Refer to the supplemental conditions section for hours of operation.
2. Do not carry out nonemergency work, including equipment moves, on Sundays without prior written authorization by the OWNER. No work shall be performed on holidays or weekends unless otherwise specified or approved.

E. Dust Control:

1. Take measures to prevent unnecessary dust. Keep earth surfaces exposed to dusting moist with water or a chemical dust suppressant. Cover materials in piles or while in transit to prevent blowing or spreading dust.
2. Adequately protect buildings or operating facilities which may be affected adversely by dust. Protect machinery, motors, instrument panels, or similar equipment by suitable dust screens. Include proper ventilation with dust screens.

F. Temporary Drainage Provisions:

1. Provide for the drainage of stormwater and any water applied or discharged on the site in performance of the Work. Provide adequate drainage facilities to prevent damage to the Work, the site, and adjacent property.
2. Supplement existing drainage channels and conduits as necessary to carry all increased runoff from construction operations. Construct dikes as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect the OWNER's facilities and the Work, and to direct water to drainage channels or conduits. Provide ponding as necessary to prevent downstream flooding.
3. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

G. Pollution: Prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. Do not permit sanitary wastes to enter any drain or watercourse other than sanitary sewers. Do not permit sediment, debris, or other substances to enter sanitary sewers. Take reasonable measures to prevent such materials from entering any drain or watercourse.

1.9 TRAFFIC REGULATION

- A. Parking: Provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Contract, to avoid any need for parking personal vehicles where they may interfere with public traffic or construction activities.
- B. Access: Conduct Work to interfere as little as possible with public travel, whether vehicular or pedestrian. Provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when the CONTRACTOR has obtained permission from the owner or tenant of private property, or from the authority having jurisdiction over the public property involved, to obstruct traffic at the designated point.

1.10 FIELD OFFICES AND SHEDS

- A. CONTRACTOR's Office: Contractor may erect, furnish, and maintain a field office with a telephone. Contractor may have an authorized agent present at this office at all times while the Work is in progress. Keep readily accessible copies of the Contract Documents, required record documents, and the latest approved shop drawings at this field office.
- B. Material Sheds and Temporary Structures: Provide material sheds and other temporary structures of sturdy construction and neat appearance.
- C. Location: Coordinate location of field offices, material sheds and temporary structures with ENGINEER and OWNER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 61 00
MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description
- B. Substitutions
- C. Manufacturer's Written Instructions
- D. Transportation and Handling
- E. Storage, Protection and Maintenance
- F. Manufacturer's Field Quality Control Services
- G. Post Startup Services
- H. Special Tools and Lubricating Equipment
- I. Lubrication

1.2 DESCRIPTION

- A. Proposed Manufacturers List: Within 15 calendar days of the date of the Notice to Proceed, submit to the ENGINEER a list of the names of proposed manufacturers, materialmen, suppliers and subcontractors, obtain approval of this list by OWNER prior to submission of any working drawings. Upon request submit evidence to ENGINEER that each proposed manufacturer has manufactured a similar product to the one specified and that it has previously been used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.
- B. Furnish and install Material and Equipment which meets the following:
 - 1. Conforms to applicable specifications and standards.
 - 2. Complies with size, make, type, and quality specified or as specifically approved, in writing, by ENGINEER.
 - 3. Will fit into the space provided with sufficient room for operation and maintenance access and for properly connecting piping, ducts and services,

as applicable. Make the clear spaces that will be available for operation and maintenance access and connections equal to or greater than those shown and meeting all the manufacturers' requirements. Make all provisions for installing equipment furnished at no increase in Contract Price.

4. Manufactured and fabricated in accordance with the following:
 - a. Design, fabricate, and assemble in accordance with best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Provide two or more items of same kind identical, by same manufacturer.
 - d. Provide materials and equipment suitable for service conditions.
 - e. Adhere to equipment capabilities, sizes, and dimensions shown or specified unless variations are specifically approved, in writing, in accordance with the Contract Documents.
 - f. Adapt equipment to best economy in power consumption and maintenance. Proportion parts and components for stresses that may occur during continuous or intermittent operation, and for any additional stresses that may occur during fabrication or installation.
 - g. Working parts are readily accessible for inspection and repair, easily duplicated and replaced.
5. Use material or equipment only for the purpose for which it is designed or specified.

1.3 SUBSTITUTIONS

A. Substitutions:

1. CONTRACTOR's requests for changes in equipment and materials from those required by the Contract Documents are considered requests for substitutions and are subject to CONTRACTOR's representations and review provisions of the Contract Documents when one of following conditions are satisfied:
 - a. Where request is directly related to an "or equal" clause or other language of same effect in Specifications.

- b. Where required equipment or material cannot be provided within Contract Time, but not as result of CONTRACTOR's failure to pursue Work promptly or to coordinate various activities properly.
- c. Where required equipment or material cannot be provided in manner compatible with other materials of Work or cannot be properly coordinated therewith.

2. CONTRACTOR'S Options:

- a. Where more than one choice is available as options for CONTRACTOR's selection of equipment or material, select option compatible with other equipment and materials already selected (which may have been from among options for other equipment and materials).
- b. Where compliance with specified standard, code or regulation is required, select from among products which comply with requirements of those standards, codes, and regulations.
- c. "Or Equal": For equipment or materials specified by naming one or more equipment manufacturer and "or equal", submit request for substitution for any equipment or manufacturer not specifically named.

B. Conditions Which are Not Substitution:

- 1. Requirements for substitutions do not apply to CONTRACTOR options on materials and equipment provided for in the Specifications.
- 2. Revisions to Contract Documents, where requested by OWNER or ENGINEER, are "changes" not "substitutions".
- 3. CONTRACTOR's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute substitutions and do not constitute basis for a Change Order, except as provided for in Contract Documents.

1.4 MANUFACTURER'S WRITTEN INSTRUCTIONS

- A. Instruction Distribution: When the Contract Documents require that installation, storage, maintenance and handling of equipment and materials comply with manufacturer's written instruction's, obtain and distribute printed copies of such instructions to parties involved in installation, including six copies to ENGINEER.
 - 1. Maintain one set of complete instructions at jobsite during storage and installation, and until completion of work.

- B. **Manufacturer's Requirements:** Store, maintain, handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's written instructions and in conformity with Specifications.
 - 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult ENGINEER for further instructions.
 - 2. Do not proceed with work without written instructions.
- C. **Performance Procedures:** Perform work in accordance with manufacturer's written instructions. Do not omit preparatory steps or installation procedures, unless specifically modified or exempted by Contract Documents.

1.5 TRANSPORTATION AND HANDLING

- A. **Coordination with Schedule:** Arrange deliveries of materials and equipment in accordance with Construction Progress Schedules. Coordinate to avoid conflict with work and conditions at site.
 - 1. Deliver materials and equipment in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 - 2. Protect bright machined surfaces, such as shafts and valve faces, with a heavy coat of grease prior to shipment.
 - 3. Immediately upon delivery, inspect shipments to determine compliance with requirements of Contract Documents and approved submittals and that material and equipment are protected and undamaged.
- B. **Handling:** Provide equipment and personnel to handle material and equipment by methods recommended by manufacturer to prevent soiling or damage to materials and equipment or packaging.

1.6 STORAGE, PROTECTION, AND MAINTENANCE

- A. **On-site storage areas and buildings:**
 - 1. Conform storage buildings to requirements of Section 01 57 00.
 - 2. Coordinate location of storage areas with ENGINEER and OWNER.
 - 3. Arrange on site storage areas for proper protection and segregation of stored materials and equipment with proper drainage. Provide for safe travel around storage areas and safe access to stored materials and equipment.

4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
5. Store materials such as pipe, reinforcing and structural steel, and equipment on pallets, blocks or racks, off ground.
6. PVC Pipe may be damaged by prolonged exposure to direct sunlight and the CONTRACTOR shall take necessary precautions during storage and installation to avoid this damage. Pipe shall be stored under cover and installed with sufficient backfill to shield it from the sun.
7. Store fabricated materials and equipment above ground, on blocking or skids, to prevent soiling or staining. Cover materials and equipment which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

B. Interior Storage:

1. Store materials and equipment in accordance with manufacturer's instructions, with seals and labels intact and legible.
2. Store materials and equipment, subject to damage by elements, in weathertight enclosures.
3. Maintain temperature and humidity within ranges required by manufacturer's instructions.

C. Accessible Storage: Arrange storage in a manner to provide easy access for inspection and inventory. Make periodic inspections of stored materials or equipment to assure that materials or equipment are maintained under specified conditions and free from damage or deterioration.

1. Perform maintenance on stored materials of equipment in accordance with manufacturer's instructions, in presence of OWNER or ENGINEER.
2. Submit a report of completed maintenance to ENGINEER with each Application for Payment.
3. Failure to perform maintenance, to notify ENGINEER of intent to perform maintenance or to submit maintenance report may result in rejection of material or equipment.

- D. OWNER's Responsibility: OWNER assumes no responsibility for materials or equipment stored in buildings or on-site. CONTRACTOR assumes full responsibility for damage due to storage of materials or equipment.
- E. CONTRACTOR's Responsibility: CONTRACTOR assumes full responsibility for protection of completed construction. Repair and restore damage to completed Work equal to its original condition.
- F. Special Equipment: Use only rubber-tired wheelbarrows, buggies, trucks, or dollies to wheel loads over finished floors, regardless of if the floor has been protected or not. This applies to finished floors and to exposed concrete floors as well as those covered with composition tile or other applied surfacing.
- G. Surface Damage: Where structural concrete is also the finished surface, take care to avoid marking or damaging surface.

1.7 MANUFACTURER'S FIELD QUALITY CONTROL SERVICES

- A. General:
 - 1. Provide manufacturer's field services in accordance with this subsection for those tasks specified in other sections.
 - 2. Provide training as specified in Section 01 79 00.
 - 3. Include and pay all costs for suppliers' and manufacturers' services, including, but not limited to, those specified.
- B. Installation Instruction: Provide instruction by competent and experienced technical representatives of equipment manufacturers or system suppliers as necessary to resolve assembly or installation procedures which are attributable to, or associated with, the equipment furnished.
- C. Installation Inspection, Adjustments and Startup Participation:
 - 1. Provide competent and experienced technical representatives of equipment manufacturers or system suppliers to inspect the completed installation as follows.
 - a. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or for other conditions which may cause damage.
 - b. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

- c. Verify that wiring and support components for equipment are complete.
 - d. Verify that equipment or system is installed in accordance with the manufacturer's recommendations, approved shop drawings and the Contract Documents.
 - e. Verify that nothing in the installation voids any warranty.
2. Provide manufacturer's representatives to perform initial equipment and system adjustment and calibration conforming to the manufacturer's recommendations and instructions, approved shop drawings and the Contract Documents.
3. Obtain ENGINEER's approval before start-up of equipment. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.
4. Furnish ENGINEER with three copies of the following. When training is specified, furnish the copies at least 24 hours prior to training.
 - a. "Certificate of Installation, Inspection and Start-up Services" by manufacturers' representatives for each piece of equipment and each system specified, certifying:
 - (1) That equipment is installed in accordance with the manufacturers' recommendations, approved shop drawings and the Contract Documents.
 - (2) That nothing in the installation voids any warranty.
 - (3) That equipment has been operated in the presence of the manufacturer's representative.
 - (4) That equipment, as installed, is ready to be operated by others.
 - b. Detailed report by manufacturers' representatives, for review by ENGINEER of the installation, inspection and start-up services performed, including:
 - (1) Description of calibration and adjustments if made; if not in Operation and Maintenance Manuals, attach copy.
 - (2) Description of any parts replaced and why replaced.
 - (3) Type, brand name, and quantity of lubrication used, if any.

- (4) General condition of equipment.
 - (5) Description of problems encountered, and corrective action taken.
 - (6) Any special instructions left with CONTRACTOR or ENGINEER.
- D. Field Test Participation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to participate in field testing of the equipment specified in Section 01 43 00.
- E. Trouble-Free Operation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to place the equipment in trouble-free operation after completion of start-up and field tests.

1.8 POST START-UP SERVICES

- A. General: Provide Post Start-up Services in accordance with this subsection for equipment specified in other sections.
- B. Site Visit: Provide the services of an authorized service representative for each equipment manufacturer or system supplier to make a final site visit after the equipment or system has been in operation for at least 6 months, but no longer than 11 months. Furnish assistance to OWNER's operating personnel in making adjustments and calibrations required to determine that the equipment and system is operating in conformance with design, manufacturers, and specification requirements. Instruct the personnel in a review of proper operation and maintenance procedures.
- C. Certificate: Furnish "Certificate of Post Start-up Services" cosigned by ENGINEER and the manufacturer's representative, certifying that this service has been performed. Use form provided in this section and furnish OWNER with three copies.

1.9 SPECIAL TOOLS AND LUBRICATING EQUIPMENT

- A. General: Furnish, per manufacturer's recommendations, special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)
- B. Time of Delivery: Deliver special tools and lubricating equipment to OWNER when unit is placed into operation and after operating personnel have been properly instructed in operation, repair, and maintenance of equipment.

- C. Quality: Provide tools and lubricating equipment of a quality meeting equipment manufacturer's requirements.

1.10 LUBRICATION

- A. General: Where lubrication is required for proper operation of equipment, incorporate in the equipment the necessary and proper provisions in accordance with manufacturer's requirements. Where possible, make lubrication automated and positive.
- B. Oil Reservoirs: Where oil is used, supply reservoir of sufficient capacity to lubricate unit for a 24-hour period.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General Requirements
- B. Scheduling of Shutdown

1.2 RELATED SECTIONS

- A. Section 32 10 01 – Pavement Repair and Restoration

1.3 GENERAL REQUIREMENTS

- A. CONTRACTOR shall be responsible for all cutting, fitting and patching, including attendant excavation and backfill, required to complete the work or to:
 - 1. Make its several parts fit together properly.
 - 2. Uncover portions of the work to provide for installation of ill-timed work.
 - 3. Remove and replace defective work.
 - 4. Remove and replace work not conforming to requirements of Contract Documents.
 - 5. Remove samples of installed work as specified for testing.
 - 6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
- B. Coordination: Perform all cutting, fitting or patching of the Work that may be required to make the several parts thereof join in accordance with the Contract Documents. Perform restoration with competent workmen skilled in the trade.
- C. Improperly Timed Work: Perform all cutting and patching required to install improperly timed work, to remove samples of installed materials for testing, and to provide for alteration of existing facilities or for the installation of new Work in the existing construction.
- D. Limitations: Except when the cutting or removal of existing construction is specified or indicated, do not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without the ENGINEER's concurrence.

1.4 SUBMITTALS

- A. Submit a written request to the ENGINEER well in advance of executing any cutting or alteration which affects:
 - 1. Work of the OWNER or any separate contractor.
 - 2. Structural value or integrity of any element of the project or work.
 - 3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
 - 4. Efficiency, operational life, maintenance or safety of operational elements.
 - 5. Visual qualities of sight-exposed elements.

- B. Request shall include:
 - 1. Identification of the work.
 - 2. Description of affected work.
 - 3. The necessity for cutting, alteration or excavation.
 - 4. Effect on work of OWNER or any separate contract, or on structural or weatherproof integrity of work.
 - 5. Description of proposed work:
 - a. Scope of cutting, patching, alteration, or excavation.
 - b. Trades who will execute the work.
 - c. Products proposed to be used.
 - d. Extent of refinishing to be done.
 - 6. Alternatives to cutting and patching.
 - 7. Cost proposal, when applicable.
 - 8. Written permission of any separate contractor whose work will be affected.

- C. SUBMIT WRITTEN NOTICE TO THE ENGINEER DESIGNATING THE DATE AND THE TIME THE WORK WILL BE UNCOVERED.

1.5 SCHEDULING OF SHUTDOWN

- A. Connections to Existing Facilities: If any connections, replacement, or other work requiring the shutdown of an existing facility is necessary, schedule such work at times when the impact on the OWNER's normal operation is minimal. Overtime, night and weekend work without additional compensation from the OWNER, may be required to make these connections, especially if the connections are made at times other than those specified.

- B. Request for Shutdowns: Submit a written request for each shutdown to the OWNER and the ENGINEER sufficiently in advance of any required shutdown.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Comply with specifications and standards for each specific product involved.

PART 3 EXECUTION

3.1 INSPECTION

- A. Inspect existing conditions of projects, including elements subject to damage or to movement during cutting and patching.
- B. After uncovering work, inspect conditions affecting installation of products, or performance of the work.
- C. Report unsatisfactory or questionable conditions to the ENGINEER in writing; do not proceed with work until the ENGINEER has provided further instructions.

3.2 PREPARATION

- A. Provide adequate temporary support as necessary to assure structural value or integrity or affected portion of work.
- B. Provide devices and methods to protect other portions of project from damage.
- C. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work and maintain excavations free from water.
- D. Material Removal: Cut and remove all materials to the extent shown or as required to complete the Work. Remove materials in a careful manner with no damage to adjacent facilities. Remove materials which are not salvageable from the site.

3.3 PERFORMANCE

- A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.
- B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.
- C. Employ original installer or fabricator to perform cutting and patching for:
 - 1. Weather-exposed or moisture-resistant elements.
 - 2. Sight-exposed finished surfaces.
- D. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

- E. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of contract documents.
- F. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
 - 1. For continuous surfaces, refinish to nearest intersection.
 - 2. For an assembly, refinish entire unit.

3.4 PAVEMENT RESTORATION

- A. Restore all pavement or roadway surfaces in accordance with Section 32 10 01 – Pavement Repair and Restoration.
- B. The restoration of existing street paving, including underdrains, if any are encountered, where damaged, shall be restored by the CONTRACTOR and shall be replaced or rebuilt using the same type of construction as was in the original. The CONTRACTOR shall be responsible for restoring all such work, including subgrade, base courses, curb and gutter or other appurtenances where present. The CONTRACTOR shall obtain and pay for at his own expense such local or other governmental permits as may be necessary for the opening of streets and shall satisfy himself as to any requirements other than those herein set forth which may affect the type, quality and manner of carrying on the restoration of surfaces by reason of jurisdiction of such governmental bodies.
- C. This section does not describe the construction of new road surfaces or the complete resurfacing of existing pavements.
- D. In all cases, the CONTRACTOR will be required to maintain, without additional compensation, all permanent replacement of street paving, done by him under this Contract for a period of 12 months after the acceptance of the Contract, including the removal and replacement of such work wherever surface depressions or underlying cavities result from settlement of trench backfill.
- E. The CONTRACTOR shall do all the final resurfacing or repaving of streets or roads, over the excavations that he has made and he shall be responsible for relaying paving surfaces of roads that have failed or been damaged, at any time before the termination of the maintenance period on account of work done by him and he shall resurface or repave over any tunnel jacking, or boring excavation that shall settle or break the surface, shall be repaved to the satisfaction of the OWNER and at the CONTRACTOR's sole expense. Backfilling of trenches and the preparation of subgrades shall conform to the requirements of excavation and backfilling of pipeline trenches.

- F. Where pipeline construction crosses paved streets, the CONTRACTOR may elect, at no additional cost to the OWNER, to place the pipe by the jacking or boring or tunneling method in lieu of cutting and patching of the paved surfaces.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 74 00

CLEANING

PART 1 GENERAL

1.1 SECTION INCLUDES:

- A. General Requirements
- B. Disposal Requirements

1.2 GENERAL REQUIREMENTS

- A. Execute cleaning during progress of the work and at completion of the work.

1.3 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 DURING CONSTRUCTION

- A. Execute daily cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.
- B. Provide onsite containers for the collection of waste materials, debris and rubbish. All waste materials including containers, food debris and other miscellaneous materials must be disposed of daily in onsite containers.
- C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.2 FINAL CLEANING

- A. Requirements: At the completion of work and immediately prior to final inspection, clean the entire project as follows:
 - 1. Thoroughly clean, sweep, wash, and polish all work and equipment provided under the Contract, including finishes. Leave the structures and site in a complete and finished condition to the satisfaction of the ENGINEER.
 - 2. Direct all subcontractors to similarly perform, at the same time, an equivalent thorough cleaning of all work and equipment provided under their contracts.
 - 3. Remove all temporary structures and all debris, including dirt, sand, gravel, rubbish and waste material.
 - 4. Should the CONTRACTOR not remove rubbish or debris or not clean the buildings and site as specified above, the OWNER reserves the right to have the cleaning done at the expense of the CONTRACTOR.
- B. Employ experienced workers, or professional cleaners, for final cleaning.
- C. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- D. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.
- E. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces. Polish surfaces so designated to shine finish.
- F. Repair, patch, and touch up marred surfaces to specified finish, to match adjacent surfaces.
- G. Replace air-handling filters if units were operated during construction.
- H. Clean ducts, blowers, and coils if air-handling units were operated without filters during construction.
- I. Vacuum clean all interior spaces, including inside cabinets.
- J. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.

- K. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
- L. Clean interior of all panel cabinets, pull boxes, and other equipment enclosures.
- M. Wash and wipe clean all lighting fixtures, lamps, and other electrical equipment which may have become soiled during installation.
- N. Perform touch-up painting.
- O. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- P. Remove erection plant, tools, temporary structures and other materials.
- Q. Remove and dispose of all water, dirt, rubbish or any other foreign substances.

3.3 FINAL INSPECTION

- A. After cleaning is complete the final inspection may be scheduled. The inspection will be done with the OWNER and ENGINEER.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01 77 00
CONTRACT CLOSE OUT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Warranties and Bonds
- B. Record Drawings
- C. Special Tools

1.2 WARRANTIES AND BONDS

Prior to final payment deliver to the OWNER the original and one copy of all bonds, warranties, guarantees and similar documents, including those customarily provided by manufacturers and suppliers which cover a period greater than the one-year correction period. Show OWNER as beneficiary of these documents.

1.3 RECORD DRAWINGS

At the site keep and maintain one record copy of all Contract Documents, reference documents and all technical documents submitted in good order. As the work progresses the Engineer or his designated representative shall record on one set of reproducible drawings all changes and deviations from the original Plans. He shall record the exact location of all changes in vertical and horizontal alignment by offsets and ties at each; sewer, water, electric, gas, communication and other services by off-set distance to permanent improvements such as building and curbs.

Prior to acceptance of the project and before final payment is made, the Engineer shall submit one (1) set of reproducible drawings, two (2) sets of blueline or blackline prints, all marked "Drawings of Record". These Record Drawings must be certified by the Florida Registered Professional Engineer, who prepared the plans and signs and seals these plans, and submits AutoCAD compatible diskette copy of the drawings, and other applicable related records to the Department of Lee County Utilities.

These Record Drawings must be certified by the Florida Registered Professional Engineer, who prepared the plans and signs and seals these plans. The Record Drawings shall include vertical and horizontal alignment of all water, sewer, and effluent reuse lines, valves, tees, bends, reducers, hydrants, pump stations, service connections, meter boxes and/or pads, and other pertinent structures.

Pipeline runs in excess of 152.4m, (500'), without fittings shall include vertical alignment information at 152.4m, (500') intervals. Said alignment shall be tied to permanent improvements, such as roadway and/or railroad centerlines and rights-of-way, building and property corners, and shall be certified by a Professional Land Surveyor, licensed in the State of Florida. The Professional Land Surveyor can coordinate with the Contractor to install the necessary appurtenances on buried utilities to facilitate the survey after construction is completed. In addition, property strap numbers and street names shall be shown on the plan.

On a case-by-case basis, Lee County Utilities may waive the requirement for certification by a Professional Land Surveyor, licensed in the State of Florida. However, prior consent must first be obtained from Lee County Utilities. The County shall withhold final acceptance of the project until the requirement for record drawings and related records has been met. Record Drawings without detailed field verified horizontal and vertical locations of all facilities shown will be rejected.

1.4 SPECIAL TOOLS

Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for maintenance of particular equipment.

For each type of equipment provided under this CONTRACT, furnish a complete set of all special tools including grease guns and other lubricating devices, which may be needed for the adjustment, operation, maintenance, and disassembly of such equipment. Furnish only tools of high grade, smooth forged alloy tool steel. Manufacture grease guns of the lever type.

Furnish and erect one or more neat and substantial steel wall cases or cabinets with flat key locks and clips or hooks to hold each special tool in a convenient arrangement.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description
- B. Quality Assurance
- C. Submittals
- D. Format and Contents

1.2 DESCRIPTION

- A. Scope: Furnish to the ENGINEER 10 copies and a PDF of an Operation and Maintenance Manual for all equipment and associated control systems furnished and installed.

1.3 QUALITY ASSURANCE

- A. Reference Codes and Specifications: No current government or commercial specifications or documents apply.

1.4 SUBMITTALS

- A. Prior to the Work Reaching 50 Percent Completion, submit to the ENGINEER for approval two copies of the manual with all specified material. Submit the approval copies with the partial payment request for the specified completion. Within 30 days after the ENGINEER's approval of the two-copy submittal, furnish to the ENGINEER the remaining 8 copies of the manual. Provide space in the manual for additional material. Submit any missing material for the manual prior to requesting certification of substantial completion.

1.5 FORMAT AND CONTENTS

- A. Prepare and arrange each copy of the manual as follows:
 - 1. One copy of an equipment data summary (see sample form) for each item of equipment.

2. One copy of an equipment preventive maintenance data summary (see sample form) for each item of equipment.
 3. One copy of the manufacturer's operating and maintenance instructions. Operating instructions include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting. Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, lubrication, troubleshooting, parts list and recommended spare parts.
 4. List of electrical relay settings and control and alarm contact settings.
 5. Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.
 6. One valve schedule giving valve number, location, fluid, and fluid destination for each valve installed. Group all valves in same piping systems together in the schedule. Obtain a sample of the valve numbering system from the ENGINEER.
 7. Furnish all O&M Manual material on 8-1/2 by 11 commercially printed or typed forms or an acceptable alternative format.
- B. Organize each manual into sections paralleling the equipment specifications. Identify each section using heavy section dividers with reinforced holes and numbered plastic index tabs. Use 3-ring, hard-back binders Type No. VS11 as manufactured by K&M Company, Torrance, CA, or equal. Punch all loose data for binding. Arrange composition and printing so that punching does not obliterate any data. Print on the cover and binding edge of each manual the project title, and manual title, as furnished and approved by the ENGINEER.
- C. Leave all operating and maintenance material that comes bound by the equipment manufacturer in its original bound state. Cross-reference the appropriate sections of the CONTRACTOR's O&M manual to the manufacturers' bound manuals.
- D. Label binders Volume 1, 2, and so on, where more than one binder is required. Include the table of contents for the entire set, identified by volume number, in each binder.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Lee County Utilities

Lakes Park Water Quality Phase 3

Equipment Data Summary

Equipment Name: Specification Reference:

Manufacturer:

Name:

Address:

Telephone:

Number Supplied: Location/Service:

Model No: Serial No:

Type:

Size/Speed/Capacity/Range (as applicable):

Power Requirement (Phase/Volts/Hertz):

Local Representative:

Name:

Address:

Telephone:

NOTES:

Lee County Utilities

Lakes Park Water Quality Phase 3

Preventive Maintenance Summary

Equipment Name:

Location:

Manufacturer:

Name:

Address:

Telephone:

Model No:

Serial No:

Maintenance
Task

Lubricant/Part

D W M Q SA A

O&M Manual
Reference

NOTES:

*D-Daily W-Weekly M-Monthly Q-Quarterly SA-Semi-Annual A-Annual

SECTION 01 78 36
WARRANTIES AND BONDS

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

- A. Compile specified warranties and bonds, as in Articles 6 and 13 of the General Conditions.
- B. Co-execute submittals when so specified.
- C. Review submittals to verify compliance with Contract Documents.
- D. Submit to the ENGINEER for review and transmittal to OWNER.

1.2 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Two original signed copies are required.
- C. Table of Contents. Neatly typed in orderly sequence. Provide complete information for each item.
 - 1. Product or work item.
 - 2. Firm, with name of principal, address and telephone number.
 - 3. Scope.
 - 4. Date of beginning warranty, bond or service and maintenance contract.
 - 5. Duration of warranty, bond or service maintenance contract.
 - 6. Provide information for OWNER's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances which might affect the validity of warranty or bond.
 - 7. CONTRACTOR, name of responsible principal, address and telephone number.

1.3 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.
- B. Format:
 - 1. Size 8-1/2" x 11", punch sheets for standard 3-post binder.

- a. Fold larger sheets to fit into binders.
- 2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS" list:
 - a. Title of Project
 - b. Name of CONTRACTOR
- C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of 2 inches.

1.4 WARRANTY SUBMITTAL REQUIREMENTS

- A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the CONTRACTOR's for one (1) year, unless otherwise specified, commencing at the time of substantial completion.
- B. The CONTRACTOR shall be responsible for obtaining certificates for equipment warranty for all major equipment. The ENGINEER 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 one-year warranty period even though certificates of warranty may not be required.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 01 79 00

TRAINING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Training

1.2 TRAINING

- A. Training: Provide the services of knowledgeable, technically competent, factory trained specialists to instruct OWNER personnel in the operation and maintenance of the equipment and system components listed in Paragraph B. The OWNER will furnish training classroom space.
 - 1. Coordinate services with the OWNER, with a minimum of 30 days prior notice.
 - 2. Provide a combination of classroom and "hands-on" instruction designed to completely familiarize operating and maintenance personnel with the systems theory, standard operating procedures, safety features and emergency procedures, and general maintenance of all components.
 - 3. Conduct all training during regular hours on weekdays.
- B. Provide training for the alum treatment system described in Specification 43 01 00.
- C. Length of Training: 8 hours.
- D. Credentials: Submit for approval, credentials of equipment manufacturer representatives who are to be course instructors at least 14 days prior to a proposed training session.
- E. Scheduling: Submit training outline and other information described in paragraphs G through K for approval at least 14 days prior to the proposed date for the training sessions. Verify scheduling with the OWNER at least 14 days prior to the training sessions.
- F. Number of Copies: For each training class, provide instructional material for at least ten attendees plus five extra copies, plus duplicate copies of all audio-visual aids utilized during each training course.

- G. Training Outline Submission: Provide a proposed training outline including the topics presented in Paragraph K. Identify specific components and procedures in the proposed training outline.
- H. Training Topic Detail: Detail specific training topics. Describe "hands-on" demonstrations planned for the training. Reference training aids to be utilized in the training (i.e. video tapes, slides, transparencies) and attach where applicable.
- I. Training Handouts: Attach training handouts to the proposed training outline.
- J. Training Segment Duration: Indicate the duration of each training segment.
- K. Training Outline:
 - 1. Equipment Operation
 - a. Describe equipment's operating (process) function.
 - b. Describe equipment's fundamental operating principles and dynamics.
 - c. Identify equipment's mechanical, electrical and electronic components and features.
 - d. Identify all support equipment associated with the operation of the subject equipment.
 - 2. Detailed Component Description
 - a. Identify and describe in detail each component's function.
 - b. Where applicable, group related components into subsystems.
 - c. Identify, and describe in detail, equipment safety features and control interlocks.
 - 3. Equipment Preventive Maintenance
 - a. Describe preventive maintenance inspection procedures required to perform and inspect the equipment in operation, and spot potential trouble symptoms (anticipate breakdowns).
 - b. Outline recommended routine lubrication and adjustments (preventive maintenance).
 - 4. Equipment Troubleshooting

- a. Define recommended systematic troubleshooting procedures.
 - b. Provide component specific troubleshooting checklists.
 - c. Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.
5. Equipment Corrective Maintenance
- a. Describe recommended equipment preparation requirements.
 - b. Identify and describe the use of special tools required for maintenance of the equipment.
 - c. Describe component removal/installation and disassembly/ assembly procedures.
 - d. Perform at least two "hands-on" demonstrations of common corrective maintenance repairs.
 - e. Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.
 - f. Define recommended torquing, mounting, calibration, and alignment procedures and settings, as appropriate.
 - g. Describe recommended procedures to check/test equipment following corrective repair.
- L. Certificate: Provide "Certificate of Instructional Services" signed by ENGINEER and equipment representative, verifying that training has been accomplished to satisfaction of all parties. Use form provided in this section and furnish ENGINEER with three copies.
- M. Substantial Completion: Training provided by manufacturers' representative, ENGINEER and OWNER does not constitute substantial completion.
- N. Equipment Use: Use of equipment for training will not void manufacturers' or contract warranties.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

CERTIFICATE OF INSTRUCTIONAL SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby certify the equipment Manufacturers' Representative has instructed OWNER's personnel in startup operation and maintenance of this equipment as required in the Contract Documents.

MANUFACTURER'S REPRESENTATIVE

Signature _____

Name: (print) _____

Title: _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

ENGINEER

Signature _____ Date _____

Name (print) _____

Title _____

COMMENTS:

Complete and submit three copies of this form to ENGINEER upon completion of training as required by Specification Section 01 79 00.

(NO TEXT FOR THIS PAGE)

SECTION 01 80 00

PRECONSTRUCTION PHOTOS/VIDEOS

PART 1 GENERAL

1.1 SCOPE

- A. Prior to commencing the WORK, the Contractor shall provide a color audio-video DVD recording of the entire construction area of the project to serve as a record of the site conditions. The Contractor will provide one copy of the pre-construction video to the OWNER and retain one copy in the Project files for turnover to the OWNER at Project Close Out. The Contractor shall review the video recordings for clarity and accuracy and shall make supplemental records of existing conditions if they are not clearly indicated.
- B. The Contractor shall notify the OWNER two weeks prior to commencement of construction within a specific geographic area in order to obtain the pre-construction video. No construction shall begin prior to review of the preconstruction video of the construction area by the OWNER and the Contractor. Video recording shall be made not more than six weeks prior to commencement of construction. One copy of all recordings and written records shall be well maintained by the Contractor without any damage and shall become the property of OWNER at Project Close Out.
- C. The Contractor may engage the services of a professional videographer. However, the color audio-video recordings shall be prepared by a responsible commercial firm or individual known to be skilled and regularly engaged in the business of preconstruction color audio-video documentation.

PART 2 PRODUCTS

2.1 VIDEO MEDIA

- A. The video portion of the recording shall produce bright, sharp, and clear pictures with accurate colors and shall be free from distortion, tearing, rolls, and any other form of picture imperfection. The audio portion of the recording shall produce the commentary of the camera operator with proper volume, clarity, and be free from distortion.
- B. Video media shall be standard Digital Video Disc (DVD) format.

2.2 RECORDED INFORMATION – VIDEO

- A. All video recordings shall contain coverage of all surface features located within the construction zone of influence and shall include, but not be limited to: all designated easements, all roadways, roadway signage (type of sign to be noted in commentary), pavements, ditches, walls, curbs, driveways (zoom in and very slowly pan across the width of the driveway from the street to the first construction joint or at least fifteen (15) feet minimum, ensuring the camera stays in sharp focus (high detail is important), in addition slowly pan from the first construction joint to garage, ensuring the camera stays in sharp focus), sidewalks, culverts, buildings, raised pavement markings, owl burrows, landscaping, shrubbery and fences. Of particular concern shall be the existence of any faults, fractures, defects, etc. Taped coverage shall be limited to one side of the site, street, easement or right of way at any one time. Tape coverage shall include all surface conditions located within the zone of influence of construction supported by appropriate audio description including the location relative to construction stations. Panning, zoom-in and zoom-out rates shall be sufficiently controlled to maintain a clear view of the object.
- B. All video recordings shall, by electronic means, display continuously and simultaneously, the date and time of recording. The video recording shall be generated with the actual taping date and time as transparent digital information. The date information shall contain the month, day and year.

2.3 RECORDED INFORMATION – AUDIO

- A. Accompanying the video recording shall be a corresponding and simultaneously recorded audio recording. Each tape shall begin with the recorded date, project name and be followed by the general location, i.e., viewing side and direction of progress. The audio track shall consist of an original live recording. The recording shall contain exclusively the narrative commentary of the electrographer, recorded simultaneously with the fixed elevation video record of the zone of influence of construction. The recording shall assist in viewer orientation and in any needed identification, differentiation, clarification, or objective description of the features being shown in the video portion of the recording, including location relative to construction stations. The audio recording shall be free from any conversations between the camera operator and any other production technicians.

2.4 VIDEO MEDIA INDEXING

- A. Video Identification: All video media shall be permanently labeled and shall be properly identified by number and project name and location.
- B. Video Logs: Each street video shall have a log of that video's contents. The

log shall describe the various segments of coverage contained on the video in terms of the names of the streets or easements, coverage beginning and end, directions of coverage, video unit counter numbers, and date.

- C. Video Index: The electrographer shall provide an index listing, in order by video number, each video number and a brief description of coverage contained on that video, including engineering station numbers.

PART 3 EXECUTION

3.01 VISIBILITY

- A. All recordings shall be performed during times of good visibility. No recording shall be done during period of significant precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subject, and to produce bright, sharp video recordings of those subjects. No taping shall be performed when more than 10% of the area to be taped contains debris or obstructions unless otherwise authorized by the OWNER.

3.02 COVERAGE

- A. In order to increase the continuity of coverage, the coverage shall consist of a single, continuous, unedited recording which begins at one end of a particular construction area and proceeds uninterrupted to the other end of the construction area.
- B. The average rate of travel during a particular segment of coverage (e.g., coverage of one side of a street) shall be indirectly proportional to the number, size, and value of the surface features within that construction area's zone of influence. The rate of travel at any given time shall not exceed one-half mile per hour.

3.03 CAMERA OPERATION

- A. Camera Height and Stability: If conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed ten feet. The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady picture.
- B. Camera Control: **Camera pan, tilt, zoom-in, and zoom-out rates shall be sufficiently controlled such that recorded objects will be clearly viewed during video playback. In addition, all other camera and recording system controls such as lens focus and aperture, video**

level, pedestal, chroma, white balance, and electrical focus shall be properly controlled or adjusted to maximize picture quality.

- C. Viewer Orientation Techniques: The audio and video portions of the recording shall maintain viewer orientation. Visual displays of all visible building addresses shall be utilized. In easements where the proposed construction location will not be readily apparent to the video viewer, the OWNER shall indicate the proposed centerline of construction.

END OF SECTION

SECTION 02 21 13
LINES AND GRADES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General
- B. Surveys
- C. Datum Plane
- D. Protection of Survey Data

1.2 GENERAL

- A. Construct all work in accordance with the lines and grades shown on the Drawings. Assume full responsibility for keeping all alignment and grade.

1.3 SURVEYS

- A. Reference Points: The OWNER will provide reference points for the work as described in the General Conditions. Base horizontal and vertical control points will be designated by the ENGINEER and used as datum for the Work. Perform all additional survey, layout, and measurement work.
 - 1. Keep ENGINEER informed, sufficiently in advance, of the times and places at which work is to be performed so that base horizontal and vertical control points may be established, and any checking deemed necessary by ENGINEER may be done, with minimum inconvenience to the ENGINEER and at no delay to CONTRACTOR. It is the intention not to impede the Work for the establishment of control points and the checking of lines and grades set by the CONTRACTOR. However, when necessary, suspend working operations for such reasonable time as the ENGINEER may require for this purpose. Costs associated with such suspension are deemed to be included in the Contract Price, and no time extension or additional costs will be allowed.
 - 2. Provide an experienced survey crew including an instrument operator, competent assistants, and any instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement of work performed by the CONTRACTOR.

1.4 DATUM PLANE

- A. All elevations indicated or specified refer to the North American Vertical Datum of 1988 (NAVD 88) and are expressed in feet and decimal parts thereof, or in feet and inches.

1.5 PROTECTION OF SURVEY DATA

- A. General: Safeguard all points, stakes, grade marks, known property corners, monuments, and benchmarks made or established for the Work. Reestablish them if disturbed and bear the entire expense of checking reestablished marks and rectifying work improperly installed.
- B. Records: Keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Furnish copies of such data to the ENGINEER for use in checking the CONTRACTOR's layout. Data considered of value to the OWNER will be transmitted to the OWNER by the ENGINEER with other records on completion of the Work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 02 40 00

DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: All work necessary for the removal and disposal of buildings, structures, foundations, piping, equipment and roadways, or any part thereof including masonry, steel, reinforced concrete, plain concrete, electrical facilities, and any other material or equipment shown or specified to be removed.
- B. Basic Procedures and Schedule: Carry out demolition so that adjacent structures, which are to remain, are not endangered. Schedule the work so as not to interfere with the day-to-day operation of the existing facilities. Do not block doorways or passageways in existing facilities.
- C. Additional Requirements: Provide dust control and make provisions for safety.

1.2 SUBMITTALS

- A. Provide all submittals, including the following, as specified in Division 1.
- B. Site Inspection: Visit the site and inspect all existing structures. Observe and record any defects which may exist in buildings or structures adjacent to but not directly affected by the demolition work. Provide the OWNER with a copy of this inspection record and obtain the OWNER's approval prior to commencing the demolition.

1.3 QUALITY ASSURANCE

- A. Limits: Exercise care to break concrete sufficiently for removal in reasonably small masses. Where only parts of a structure are to be removed, cut the concrete along limiting lines with a suitable saw so that damage to the remaining structure is held to a minimum.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION OF EXISTING DRAWINGS

- A. Drawings of existing structures and equipment will be available for inspection at the office of the OWNER.

3.2 PROTECTION

- A. General Safety: Provide warning signs, protective barriers, and warning lights as necessary adjacent to the work as approved or required. Maintain these items during the demolition period.
- B. Existing Services: Undertake no demolition work until all mechanical and electrical services affected by the work have been properly disconnected. Cap, reroute or reconnect interconnecting piping or electrical services that are to remain in service either permanently or temporarily in a manner that will not interfere with the operation of the remaining facilities.
- C. Hazards: Perform testing and air purging where the presence of hazardous chemicals, gases, flammable materials or other dangerous substances is apparent or suspected, and eliminate the hazard before demolition is started.

3.3 DEMOLITION REQUIREMENTS

- A. Explosives: The use of explosives will not be permitted.
- B. Protection: Carefully protect all mechanical and electrical equipment against dust and debris.
- C. Removal: Remove all debris from the structures during demolition and do not allow debris to accumulate in piles.
- D. Access: Provide safe access to and egress from all working areas at all times with adequate protection from falling material.
- E. Protection: Provide adequate scaffolding, shoring, bracing railings, toe boards and protective covering during demolition to protect personnel and equipment against injury or damage. Cover floor openings not used for material drops with material substantial enough to support any loads placed on it. Properly secure the covers to prevent accidental movement.
- F. Lighting: Provide adequate lighting at all times during demolition.
- G. Closed Areas: Close areas below demolition work to anyone while removal is in progress.

- H. Material Drops: Do not drop any material to any point lying outside the exterior walls of the structure unless the area is effectively protected.

3.4 DISPOSAL OF MATERIALS

- A. Final Removal: Remove all debris, rubbish, scrap pieces, equipment, and materials resulting from the demolition unless otherwise indicated. Take title to all demolished materials and remove such items from the site.
- B. OWNER's Property: In addition to any items which may be shown, the following items remain the property of the OWNER. Remove carefully, without damage, all items listed or shown, and stockpile as directed.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 03 11 00
CONCRETE FORMWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Provide concrete formwork for architectural concrete and structural concrete as specified to form concrete to profiles shown.
1. Architectural concrete is defined as concrete for the following exposed reinforced concrete surfaces:
 - a. Interior walls
 - b. Exterior walls to 6 inches below finish grade
 - c. Interior tank walls to 6 inches below normal operating water level
 - d. Beams
 - e. Columns
 - f. Undersides of floor slabs, roof slabs and stairs
 2. Provide concrete with smooth rubbed finish.
 3. Structural concrete is defined as all concrete that is not architectural concrete.
- B. Related Work Specified in Other Sections Includes:
1. Section 03 15 00 - Concrete Accessories
 2. Section 03 20 00 - Concrete Reinforcement
 3. Section 03 40 00 - Precast Concrete Structures

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
1. ACI 318 - Building Code Requirements for Reinforced Concrete
 2. ACI SP-4 - Formwork for Concrete

3. ACI 303R - Guide to Cast-in-Place Architectural Concrete
4. ACI 347 - Guide to Formwork for Concrete

1.3 SUBMITTALS

- A. Provide all submittals, including the following, as specified in Division 1.
 1. CONTRACTORS Shop Drawings: Proposed form layout drawings and tie pattern layout drawings for Concrete. Review of these drawings does not relieve the CONTRACTOR of responsibility for adequately designing and constructing forms.
 2. Samples: Pieces of each type of sheeting, chamfer strips, form ties, form liners and rustication strips

1.4 QUALITY ASSURANCE

- A. Formwork Compliance: Use formwork complying with ACI SP-4, ACI 347 and ACI 303R.
- B. Mock-Up Erection: Erect, on the site where directed, a full-size mock-up of a cast-in-place wall or panel a minimum of 10 feet by 10 feet by 12 inches thick as shown. Conform mock-up to requirements of ACI 303R.
 1. Reinforce the panel as shown. Use form ties the same as those approved and with the form tie pattern similar to that approved. Use one face of the panel for smooth architectural concrete including "reveal" rustication with form joints, and the opposite face for form liner concrete.
 2. Plug the tie holes as specified to determine the correct mortar mixture to match the panel color. If required, remove and replace tie hole plugging mortar until an acceptable color match is obtained. After the sample panels have been approved, intentionally damage and patch portions of the finish surface of the panels for the purpose of determining the correct mixture for patching mortar and patching technique to match the original panel color and surface.
 3. Leave the approved mock-up on the job during construction as the standard of workmanship for the project. Remove mock-up from the premises after completion of the work.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Acceptable manufacturers are listed in the LCU Approved Materials List. Other manufacturers of equivalent products may be submitted.

2.2 MATERIALS

- A. Structural Concrete: Provide structural concrete form materials as follows:
 - 1. Obtain approval for form material before construction of the forms.
 - 2. Use a barrier type form release agent.
 - 3. Use form ties, hangers, and clamps of such type that, after removal of the forms, no metal will be closer than one inch from concrete surface. Wire ties will not be permitted.
 - 4. Provide ties with swaged washers or other suitable devices to prevent seepage of moisture along the ties. Leave the ties in place.
 - 5. Use lugs, cones, washers, or other devices which do not leave holes or depressions greater than 7/8-inch in diameter.
- B. Architectural Concrete: Provide architectural concrete form materials as follows:
 - 1. Construct forms using 3/4-inch thick, High Density Overlay (HDO) Plyform, Class 1 or 2, meeting the requirements of the American Plywood Association. Use surfacing materials having a minimum weight of 60-60.
 - 2. Use form coating and use thinner as recommended by manufacturer of the form coating, to coat cut or raw edges.
 - 3. Use she-bolts with water seals for form ties.
 - 4. Use form liners (see LCU Approved Materials List) having one-inch deep relief, in a fractured rib pattern to match existing. Furnish form liners in full height lengths with no horizontal joints, except where shown. Use wood for forms to be used with form liners.
 - 5. Use elastomeric vertical "V-groove" rustications in the concrete bands and the horizontal rustication joints shown in the form liner concrete of the profile shown.

6. Use a barrier type VOC compliant form release agent.

PART 3 EXECUTION

3.1 DESIGN

- A. Design Responsibility: Be responsible for the design, engineering and construction of the architectural concrete formwork and the structural concrete formwork. Conform the work to the recommendations of ACI SP-4 and ACI 303R.
- B. Setting Time and Slag Use: The presence of fly ash or ground granulated blast furnace slag in the concrete mix for architectural concrete and structural concrete will delay the setting time. Take this into consideration in the design and removal of the forms.
- C. Responsibility During Placement: Assume and take sole responsibility for adequate design of all form elements for support of the wet concrete mixtures specified and delivered.
- D. Consistency: Design forms to produce concrete members identical in shape, lines and dimensions to members shown.

3.2 CONSTRUCTION DETAILS FOR FORMWORK

- A. Structural Concrete Details: Follow the following details for all structural concrete:
 1. Provide forms which are substantial, properly braced, and tied together to maintain position and shape and to resist all pressures to which they may be subjected. Make forms sufficiently tight to prevent leakage of concrete.
 2. Determine the size and spacing of studs and wales by the nature of the work and the height to which concrete is placed. Make forms adequate to produce true, smooth surfaces with not more than 1/8-inch variation in either direction from a geometrical plane. Provide horizontal joints which are level, and vertical joints which are plumb.
 3. Supply forms for repeated use in sufficient number to ensure the required rate of progress.
 4. Thoroughly clean all forms before reuse and inspect forms immediately before concrete is placed. Remove deformed, broken, or defective forms from the work.
 5. Provide temporary openings in forms at convenient locations to facilitate cleaning and inspection.

6. Coat the entire inside surfaces of forms with a suitable form release agent just prior to placing concrete. Form release agent is not permitted on the reinforcing steel.
 7. Assume and take responsibility for the adequacy of all forms and remedying any defects resulting from their use.
- B. Architectural Concrete Details: Follow the following details for all Architectural Concrete:
1. Conform all construction details for formwork to "Construction Details for Formwork," subsections A1, A2, A3, A4, A6 and A7 and the requirements of this section.
 2. Thoroughly clean and lightly recoat HDO plywood panels before each additional use. Do not use forms more than three times.
 3. Install form liners and rustication strips in strict accordance with the manufacturer's written instructions and recommendations. Clog the ends of the form liner pattern and tape all form joints and edges using 1/8-inch thick by 3/4-inch wide foam tape centered on the joints, then caulk in accordance with the manufacturer's recommendations each time forms are set. Have a representative of the manufacturer present at the site to supervise the installation of the form liner for the entire project.
 4. Install forms for smooth concrete in such a manner that there will be no horizontal form joints, and align the forms so that vertical joints occur only at "V-Groove" rustications. Space form ties in a uniform pattern vertically and horizontally. Position form ties in smooth concrete bands and in panels between "reveal" rustications, if any.
 5. Erect beam and girder soffits with a camber of 1/2-inch in 20 feet and sufficiently braced, shored, and wedged to prevent deflection. Clamp column sides in accordance with this specification with metal column clamps, spaced according to the manufacturer's directions.
 6. Provide external angles of walls, beams, pilasters, columns, window openings and girders with 3/4-inch bevel strips.
 7. Give surfaces of concrete panel forms one thinned coat of form film.
 8. Apply the release agent in strict accordance with the manufacturer's instructions.

3.3 FORM REMOVAL

A. Structural Concrete Form Removal: Do not remove forms for structural concrete until the concrete has hardened sufficiently to support its own load safely, plus any superimposed load that might be placed thereon. Leave the forms in place for the minimum length of time indicated below or until the concrete has reached the minimum strength indicated as determined by testing, whichever time is reached first.

1. The times indicated represent cumulative days or hours, not necessarily consecutive, during which the air surrounding the concrete is above 50 degrees F. These times may be decreased if reshores are installed.

	Minimum Time	Minimum Strength (psi)
a. Columns	12 hrs.	1300
b. Columns	12 hrs.	1300
c. Side forms for girders and beams	12 hrs.	1300
d. Walls	12 hrs.	1300
e. Bottom forms of slabs		
Under 10 feet clear span	4 days	2300
10 to 20 feet clear span	7 days	2700
Over 20 feet clear span	10 days	2900
f. Bottom forms of beams and girders		
Under 10 feet clear span	7 days	2700
10 to 20 feet clear span	14 days	3000
Over 20 feet clear span	21 days	3500

2. Increase form removal times as required if concrete temperature following placement is permitted to drop below 50 degrees F or if fly ash or ground granulated blast furnace slag is used in the concrete mix.

3. Withdraw the removable portion of form ties from the concrete immediately after the forms are removed. Clean and fill holes left by such ties with grout as specified in Cast-In-Place Concrete, Subsection Structural Concrete Surfaces.

4. Plug tie holes flush with the surface using Portland cement mortar. Prewet tie holes with clean water and apply a neat cement slurry bond coat. Densely tamp mortar of a dry-tamp consistency into the tie holes exercising care so as not to smear mortar onto the finished concrete surface. Include

sufficient white cement in the mortar mix to cause the plugged holes to blend in with the adjacent surfaces. Make sample patches with different mixes to assure that this requirement is met.

- B. Architectural Concrete Form Removal: Remove forms for architectural concrete in accordance with the above subsection 3.3 A, except that do not remove forms for vertical surfaces sooner than 12 hours nor longer than 36 hours after placement of concrete.

3.4 RESHORING

- A. Reshoring Method: Develop a system for reshoring and early removal of forms, in the event early stripping of forms becomes necessary. Include details and schedules in this system for each element which is to be reshored.
- B. Construction Load Support: Do not support construction loads upon any unshored portion of the structure exceeding the structural design loads.

3.5 TOLERANCES

- A. Tolerance Limits: Design, construct and maintain concrete form and place the concrete to provide completed concrete work within the tolerance limits set forth in ACI SP-4.

3.6 SURVEY OF FORMWORK

- A. Field Survey: Employ an engineer or surveyor to check by instrument survey the lines and levels of the completed formwork before concrete is placed and make whatever corrections or adjustment to the formwork are necessary to correct deviations from the specified tolerances.
- B. Placement Surveying Requirements: Check formwork during the placement of the concrete to verify that the forms, braces, tie rods, clamps anchor bolts, conduits, piping, and the like, have not been knocked out of the established line, level or cross section by concrete placement or equipment.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 03 15 00
CONCRETE ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for providing concrete accessories shown and specified herein such as waterstops, dovetail anchor slots, cast-in-place reglets, inserts, joint filler, preformed joint seal, joint sealant and neoprene pads.
- B. Products Installed: Waterstops, dovetail anchor slots, cast-in-place reglets, inserts, joint filler, preformed joint seal, joint sealant and neoprene pads.
- C. Related Work Specified in Other Sections Includes:
 - 1. Section 03 11 00 - Concrete Formwork
 - 2. Section 03 20 00 - Concrete Reinforcement
 - 3. Section 03 40 00 – Precast Concrete Structures

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. AASHTO - Standard Specifications for Highway Bridges
 - 2. ASTM A 240 - Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
 - 3. ASTM A 536 - Standard Specifications for Ductile-Iron Castings
 - 4. ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
 - 5. ASTM D 3545 - Test Methods for Alcohol Content and Purity of Acetate esters by Gas Chromatography
 - 6. ASTM D 3575 - Test Methods for Flexible Cellular Materials Made From Olefin Polymers
 - 7. CRD-C513 - Specifications for Rubber Waterstops

8. CRD-C572 - Specifications for Polyvinyl Chloride Waterstop
9. Fed. Spec. TT-S-00227 - Sealing Compound, Elastomeric Type, Multicomponent (for Calking, Sealing, and Glazing in Buildings and Other Structures)
10. Fed. Spec. TT-S-00230 - Sealing Compound, Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)

1.3 SUBMITTALS

- A. General: Provide all Work-related submittals, including the following, as specified in Division 1.
- B. Product Data and Information:
 1. Manufacturer's Data and Specifications: Submit printed manufacturer's data and specifications for each item used on this project.
 2. Samples: Provide one sample of each item used.
 3. Joint Sealant and Preformed Joint Seal: Indicate special procedures, surface preparation and perimeter conditions requiring special attention. All products in contact with potable water, shall be "NSF Standard 61" certified. Submit certified material records indicating approval for use with potable water.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle all products and materials as specified in Division 1.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Acceptable manufacturers are listed in the LCU Approved Materials List. Other manufacturers of equivalent products may be submitted.

2.2 MATERIALS

- A. Extruded Waterstops: Provide waterstops made of extruded polyvinyl chloride unless otherwise shown or specified.

1. Do not use any reclaimed plastic material in their manufacture.
 2. Provide plastic waterstops meeting the requirements of CRD-C572, except as modified herein. Provide a Shore A/10 durometer hardness between 73 and 79, the tensile strength not less than 1850 psi, and specific gravity not more than 1.38.
 3. Unless otherwise shown, use waterstops for construction joints which are flat, at least 6 inches wide, and not less than 3/8-inch thick at the thinnest section. Provide these waterstops with ribbed longitudinal strips.
 4. Unless otherwise shown, provide waterstops for expansion joints at least 9 inches wide and not less than 1/4-inch thick at the narrowest point and not less than 3/8-inch thick immediately adjacent to the center of the waterstop. Provide the waterstop with ribbed longitudinal strips with a 3/4-inch inside diameter hollow bulb center. Limit joint movement to 1/4-inch under a tensile force of not more than 500 pounds per lineal inch.
- B. Stainless Steel Waterstops: Provide stainless steel waterstops where shown or specified.
1. Fabricate stainless steel waterstops from ASTM A 240 Type 316, 20-gauge stainless steel, conforming to the dimensions and profiles shown.
 2. Prefabricate and miter corners and intersections for all stainless steel waterstops. Make only butt joints in the field.
- C. Rubber Waterstops: Provide rubber water stops where shown or specified.
1. Provide rubber water stops of either the molded or extruded type, fabricated from a high-grade tread type compound, either SBR or natural rubber, conforming to CRD-C513.
 2. Provide water stops for construction joints at least 6 inches wide and 3/8-inch thick and with solid end bulbs 3/4-inch in diameter.
 3. Provide water stops for expansion joints 9 inches wide and 3/8-inch thick and with solid end bulbs 1-inch in diameter and a hollow center bulb 1-1/2 inches in diameter with a 3/4-inch diameter center cavity.
- D. Expansion Joint Filler: Use joint filler for all expansion joints.
1. Provide a closed cell polyethylene or PVC joint filler of the thickness shown.

E. Joint Sealant Requirements: Finish expansion joints with a joint sealant where shown or specified.

1. Joint sealant materials may be either a single component urethane compound meeting the requirements of Fed. Spec. TT-S-00230C, or a 2-component urethane compound meeting the requirements of Fed. Spec. TT-S-00227E, except as modified in this specification.
2. Provide the urethane sealant of 100 percent polymer, non-extended, containing no solvent, lime, or coal tar. Color as selected by the ENGINEER, but not black. Conform sealant properties to the following:

	Property	Value	Test Method
a.	Maximum final cure	3 days	--
b.	Minimum tensile strength	140 to 200 psi	ASTM D 412
c.	Minimum elongation	400%	ASTM D 412
d.	Modulus at 100% elongation	40-60 psi	ASTM D 412
e.	Shore A hardness	25-40	ASTM D 2240
f.	Solid content	98-100%	--
g.	Peel strength	20-40 lb/in.	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E
h.	Minimum recovery	80-90%	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E
i.	Initial tack-free cure	24-48 hrs.	Fed. Spec. TT-S-00230C Fed. Spec. TT-S-00227E

3. Provide primer as recommended by the manufacturer of the sealant, subject to approval.
4. Provide fillers and backup materials in contact with sealant which are nonimpregnated and free from asphalt, creosote, oil or extractable plasticizers. Use a backup material of a closed cell polyethylene foam rod with a diameter 1/4-inch larger than the joint width.

- F. Preformed Joint Seal: Provide a preformed joint seal where shown or specified.
1. Provide joint material which is resilient, non-extrudable, impermeable, closed-cell, cross-linked, ethylene vinyl acetate, low density, polyethylene copolymer, nitrogen blown material which is ultraviolet light, weather and wear resistant, and which is concrete beige in color.
 2. Conform material properties with the following:

Property	Value	Test Method
a. Density, pcf	2.8 to 3.4	ASTM D 3575 Suffix: W, Method A
b. Water Absorption total immersion 3 months	0.02% by volume	ASTM D 3575 Suffix: L
c. Tensile Strength	125 psi	ASTM D 3575 Suffix: T
d. Elongation before breaking	255%	ASTM D 3575 Suffix: T
e. Working Temperature	-94 to 160 F	--
- G. Neoprene Pads: Use neoprene pads as shown or required where slabs or beams must be prevented from bonding to footings, walls, columns or other rigid parts of the structure.
1. Use neoprene pads of a structural grade meeting the requirements of Section 25, Division 2 of the AASHTO Standard Specifications for Highway Bridges.
 2. Do not use neoprene pads thinner than 1/4-inch.
- H. Wedge Inserts: Make wedge inserts for 5/8-inch and 3/4-inch bolts of ductile iron conforming to ASTM A 536.
- I. Dovetail Anchors: Provide dovetail anchors of one of the following types:
1. Dovetail anchors having a 3/16-inch by 1-inch by 1/2-inch stainless steel dovetail section with 3/16-inch diameter stainless steel wire.
 2. Dovetail anchor slots of 24-gauge galvanized steel 1-inch by 1-inch by 5/8-inch throat. Fill anchor slots.
- J. Flashing Reglets: Provide flashing reglets of 24-gauge galvanized steel foam filled reglets.

PART 3 EXECUTION

3.1 INSTALLING OF WATERSTOPS

- A. Assembly of Extruded Waterstops: Prefabricate corners and intersections for all waterstops. Make only butt joints in the field. Miter and assemble corners and intersections with approved equipment, as described for field joints.
1. Make field joints by cutting the ends of the sections to be spliced so they will form a smooth even butt joint. Heat the cut ends with the splicing tool until the plastic melts. Press the two ends together until the plastic cools. Do splicing in a way that limits damage to the continuity of the ribbed strips.
 2. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.
- B. Prefabricated Stainless Steel Waterstops: Prefabricate corners and intersections for all stainless steel waterstops. Make only butt joints in the field. Miter and weld corners and intersections.
1. Provide field joints having a nominal 1-inch lap joint, with the exposed edge welded or brazed on each side.
 2. Make field joints with PVC waterstops as shown.
 3. At expansion joints, seal the base of the expansion section of the waterstop with at least one layer of 2-inch wide duct tape.
 4. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.
- C. Splices: Use splices made in the manufacturer's plant where possible for rubber waterstops.
1. Use a preformed rubber union or fitting and splicing cement as recommended by the manufacturer when splices are made.

2. Carry waterstops in the walls into lower slabs and join them to the waterstops in the slabs. Make all waterstops continuous. Set waterstops accurately to the position and line shown. Hold edges securely fixed in position at intervals of not more than 24 inches so that they will not move during the placing of the concrete. Do not drive nails through the waterstops.
- D. Joint Filler Placement: Place joint filler for expansion joints against the completed portion of the work before the concrete for the next section is placed.
1. Fasten the filler to the hardened concrete with a compatible adhesive in accordance with manufacturer's instructions. Extend the filler through the thickness of the wall or slab and make it flush with the finished surface, except where a preformed joint seal or joint sealant is shown.
 2. In joints having a waterstop, fit the filler accurately on each side of the waterstop to prevent the intrusion of concrete.
- E. Preparation of 2-Component Sealants: Mix 2-component joint sealant using a slotted paddle and slow speed mixer for 5 to 8 minutes, continually working paddle from top to bottom until the sealant color is uniform. Scrape down the side of the container and paddle blade several times during the mixing operation to ensure uniform mixing.
1. Properly prepare joint surfaces by removing all foreign matter and concrete laitance so that concrete surfaces are structurally sound, clean, dry, and free of all oil, grease, wax, waterproofing compounds or form release materials prior to the application of primer and sealant.
 2. Prime all concrete joint surfaces and all surfaces exposed to water prior to sealing, with no exceptions. Prime all other surfaces as recommended by the manufacturer of the sealant. Provide the prime as recommended by the manufacturer of the sealant, subject to approval. Apply the primer by either brushing or spraying on the joint surfaces. Apply and install the sealant within 2 to 24 hours after the application of primer.
 3. For horizontal joints, install the sealant by pouring directly from a suitable shaped can or by flowing from a bulk-loading gun.
 4. Fill vertical joints from a gun, starting from the bottom, to avoid bridging and the formation of air voids.
 5. Fill overhead joints from a gun, by laying a bead along each side of the joint and then filling the middle. Immediately after installation, tool in the sealant in order to establish firm contact with joint surfaces and to provide a smooth sealant surface. Tool in accordance with the manufacturer's instructions.

6. Control joint depth with the use of joint fillers and backup materials. Make joint widths and sealant depths as shown. Do not exceed 1/2-inch for sealant depth.
- F. Preformed Joint Seal Surface Preparation: Properly prepare joint surfaces by removing all foreign matter and concrete laitance so that concrete surfaces are structurally sound, clean, dry, and free of all oil, grease, wax, water-proofing compounds or form release materials.
1. Blast clean or saw cut all existing concrete surfaces to expose a clean bare concrete surface. Allow new concrete to be well cured and attain a minimum of 80 percent of the specified strength before installing sealant.
 2. Apply bonding adhesive, as recommended by the manufacturer to the concrete surfaces in strict compliance with the manufacturer's recommendations. Install the joint material under a compression of 25 percent and in one continuous operation, in accordance with manufacturer's recommendations. Do all splices and directional changes using heat welding method as recommended by the manufacturer.
- G. Unbonded Joints: Use unbonded horizontal joints as shown or required where slabs of beams must be prevented from bonding to footings, walls, columns or other rigid parts of the structure.
1. Prevent bonding by use of structural grade neoprene pads placed over the bearing surface of the footing, wall or other supporting part of the structure so as to isolate it from the new concrete being placed.
- H. Encasing Inserts: Encase wedge inserts, flashing reglets and dovetail anchor slots in the concrete as shown. Take special care to place and maintain them to the proper lines and grades and to compact concrete thoroughly around them to prevent the passage of water. Set these items before placing concrete and thoroughly brace them to prevent movement during the progress of the work. Provide dovetail anchor slots spaced not more than 16 inches apart for all concrete walls faced with masonry.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for providing concrete reinforcement as shown and specified herein. Reinforcement includes all steel bars, wire and welded wire fabric as shown and specified.

- B. Related Work Specified in Other Sections Includes:
 - 1. Section 03 11 00 - Concrete Formwork
 - 2. Section 03 15 00 - Concrete Accessories
 - 3. Section 03 40 00 - Precast Concrete Structures

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. ACI SP66 - ACI Detailing Manual
 - 2. ACI 318 - Latest edition "Building Code Requirements for Reinforced Concrete"
 - 3. ASTM A 185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 - 4. ASTM A 615/A615M - Deformed and Plains Billet-Steel Bars for Concrete
 - 5. ASTM A 706/A706M - Low Alloy Steel Deformed Bars for Concrete Reinforcement
 - 6. ASTM A 775/A775M - Epoxy Coated Reinforcing Steel Bars
 - 7. AWS D1.4 - Structural Welding Code - Reinforcing Steel
 - 8. ACI 315 Details - Guide to Presenting Reinforcing Steel Design
 - 9. CRSI Bars - Recommended Practice for Placing Reinforcing

1.3 SUBMITTALS

- A. Provide all submittals, including the following, as specified in Division 1.
1. Product Data and Information: Submit manufacturers literature with product data, and material description of fusion bonded epoxy coating for reinforcement and reinforcement accessories, including manufacturer's recommendations for field touch-up of mars and cut ends when epoxy coated reinforcement is specified to be used.
 2. CONTRACTORS' Shop Drawings: Submit checked Working Drawings, including bar lists, schedules, bending details, placing details and placing plans and elevations for fabrication and placing reinforcing steel conforming to "ACI Detailing Manual SP-66".
 - a. Do not bill wall and slab reinforcing in sections. Show complete elevations of all walls and complete plans of all slabs, except that, when more than one wall or slab are identical, only one such elevation or plan is required. These plans and elevations need not be true views of the walls or slabs shown. Bill every reinforcing bar in a slab on a plan. Bill every reinforcing bar in a wall on an elevation. Take sections to clarify the arrangement of the steel reinforcement. Identify all bars, but do not bill on such sections.
 - b. For all reinforcing bars, unless the location of a bar is clear, give the location of such bar or bars by a dimension to some structural feature which will be readily distinguishable at the time bars are placed.
 - c. Make the reinforcing steel placing drawings complete for placing reinforcement including the location of support bars and chairs, without reference to the design drawings.
 - d. Submit Detailer certification that every reinforcing steel placing drawing and bar list is completely checked and corrected before submittal for approval.
 - e. If, after reinforcing steel placing drawings and bar lists have been submitted for approval, a review reveals that the drawings and lists obviously have not been checked and corrected they will be returned for checking and correcting by the Detailer.
 3. Samples: Submit the following samples when epoxy coated reinforcement is specified to be used.
 - a. 12-inch long epoxy-coated steel reinforcing bar, of any size typical to this Project

- b. One of each type of epoxy-coated reinforcement accessory used on this Project
 - c. 12-inch long, nylon coated tie wire
4. Certificates: Test certificates of the chemical and physical properties covering each shipment of reinforcing steel bars.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle all products and materials as specified in Division 1 (and as follows:)
- 1. Delivery Requirements: Have reinforcing steel delivered to the work in strongly tied bundles. Identify each group of both bent and straight bars with a metal tag giving the identifying number corresponding to the reinforcing steel placing drawings and bar lists.
 - 2. Storage: Properly store all bars in an orderly manner, with all bars completely off the ground. Keep bars clean after delivery to the site of the work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers are listed in the LCU Approved Materials List. Other manufacturers of equivalent products may be submitted.

2.2 MATERIALS

- A. Steel Bars: Use new billet steel bars, deformed bars, meeting the requirements of ASTM A 615/A625M Grade 60 for reinforcing steel bars.
- 1. Roll all reinforcing steel bars with special deformations or identifying marks indicating the ASTM Specification and Grade.
 - 2. Use bars free from defects, kinks and from bends that cannot be readily and fully straightened in the field.
 - 3. Supply reinforcing bars in lengths which will allow convenient placement in the work and provide the required lap of joints as shown. Provide dowels of proper length, size and shape for tying walls, beams, floors, and the like together.

- B. Epoxy Coating: Conform fusion bonded epoxy coated reinforcing steel bars to ASTM A 775/A775M when used. Leave portions of the reinforcing steel bars uncoated where mechanical connections are shown.
- C. Welded Wire Fabric: Use welded wire fabric of the electrically welded type, with wires arranged in rectangular patterns, of the sizes shown or specified and meeting the requirements of ASTM A 185.
- D. Supports and Accessories: Provide bar supports and other accessories and, if necessary, additional supports to hold bars in proper position while concrete is being placed.
 - 1. Use side form spacers against vertical or sloping forms to maintain prescribed side cover and cross position of bars.
 - 2. Use individual hi-chairs with welded cross ties or circular hoops to support top bars in slabs thicker than 8 inches.
 - 3. Bolsters, chairs and other accessories:
 - a. Use hot-dipped galvanized or provide plastic coated legs when in contact with forms for surfaces of concrete other than architectural surfaces.
 - b. Use stainless steel when in contact with forms for architecturally exposed surfaces.
 - c. Use epoxy coated bolsters, chairs and accessories including wire ties for epoxy coated reinforcing bars.
 - d. Use chairs of an approved type and space them properly to support and hold reinforcing bars in position in all beams and slabs including slabs placed directly on the subgrade or work mat. Do not use continuous hi-chairs for supporting of top bars in slabs over 8 inches in thickness.
- E. Mechanical Connections: Provide mechanical connections that develop at least 125 percent of the specified yield strength of the bar in tension.
- F. Stirrups and Ties: Provide stirrups and ties as shown and specified and meeting the requirements of ASTM A 185.

2.3 FABRICATION

- A. Drawing Review Prior to Fabrication: Do not fabricate any material before final review and approval of shop drawings.
- B. Bending and Cutting: Cut bars to required length and bend accurately before placing. Bend bars in the shop unless written approval for field bending is obtained. If field bending is permitted, do it only when the air temperature, where the bending operation is performed, is above 30 degrees F. Do not field bend bars which have been partially embedded in concrete.
- C. Splices: Use lapped splices for tension and compression splices unless otherwise noted.
- D. Cleaning: Clean and bend reinforcement in accordance with ACI 315 and ACI 318.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Placement: Place all bars in accordance with CRSI "Recommended Practice for Placing Reinforcing Bars".
- B. Tolerances: Place bars used for top reinforcement in slabs to a vertical tolerance of plus or minus 1/4-inch. Place all other reinforcement to the tolerances given to ACI 318.
- C. Cleaning: Have reinforcing steel delivered without rust other than that accumulated during transportation to the work. At all times, fully protect reinforcing steel from moisture, grease, dirt, mortar and concrete. Before being placed in position, thoroughly clean reinforcing steel of all loose mill scale and rust and of any dirt, oil, grease coatings, or other material that might reduce the bond. If there is a delay in depositing concrete, inspect and satisfactorily clean the steel immediately before the concrete is placed.
- D. Bar Positioning: Place bars in the exact positions shown with the required spacing and cross wire bars securely in position at intersections to prevent displacement during the placing of the concrete. Fasten the bars with annealed wire of not less than 17 gauge or other approved devices.
- E. Bar Extension Beyond Formwork: On any section of the work where horizontal bars extend beyond the length of the forms, perforate the form or head against which the work ends or at the proper places to allow the bars to project through a distance at least equal to the lap specified.

- F. Unacceptable Materials: Do not place reinforcing steel with damaged, unsuitably bonded epoxy-coating or rusting. If approved, mars, exposed threads of mechanical connections and cut ends may be field coated with approved epoxy coating material.
- G. Review of Placement: Have reinforcing placement reviewed by the ENGINEER before concrete is placed.
- H. Welding - Not Approved: Do not use reinforcing bar assemblies made by welding of any kind, or accessories of any kind which require field welding to reinforcing bars.
- I. Welding - Approved: Where welding of reinforcing steel is shown, AWS D1.4 "Structural Welding Code - Reinforcing Steel" applies.
- J. Tension and Compression Lap Splices: Conform tension and compression lap splices to ACI 318 with all supplements. Avoid splices at points of maximum tensile stress wherever possible. Provide temperature bars with the clear spacing shown. Stagger all bar splices in hoop tension bars in circular tanks with not more than 50 percent of the bars spliced in any one direction. Have welded splices made by certified welders in accordance with AWS D1.4.
- K. Welded Wire Fabric: Place welded wire fabric in the positions shown, specified or required to fit the work. Furnish and place suitable spacing chairs or supports, as specified for bars, to maintain the fabric in the correct location. Where a flat surface of fabric is required, provide flat sheets, when available. Otherwise, reverse roll the fabric or otherwise straighten to make a perfectly flat surface before placing. Obtain approval for the length of laps not indicated.
- L. Concrete Cover: Place reinforcing steel and welded wire fabric and hold in position so that the concrete cover, as measured from the surface of the bar or wire to the surface of the concrete, is as shown or specified.

END OF SECTION

SECTION 03 40 00

PRECAST CONCRETE STRUCTURES

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. Furnish all materials, labor, and equipment and construct manholes, wet wells, valve vaults, meter pits, and accessory items, consisting of precast sections as shown on the Drawings and as specified herein.
- B. The forms, dimensions, concrete, and construction methods shall be approved by the ENGINEER in advance of construction.
- C. These specifications are intended to give a general description of what is required, but do not purport to cover all of the structural design details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, shop testing, delivery, and complete installation of all precast structures whether specifically mentioned in these specifications or not.
- D. The supplier of the precast manholes, wet wells, valve vaults, meter pits, and accessory items shall coordinate his work with that of the CONTRACTOR to the end that the unit will be delivered and installed in the excavation provided by the CONTRACTOR, in accordance with the CONTRACTOR's construction schedule.
- E. Coordinate the precast structures fabrication with the equipment supplied to achieve the proper structural top slab openings, spacings, and related dimensions for the selected equipment frames and covers. The top slabs, frames, covers, and subsurface structures shall be capable of supporting a live load of 150 pounds per square foot.

1.2 SUBMITTALS

- A. Submit to the ENGINEER, as provided in the General Conditions, shop drawings signed and sealed by an engineer registered by the State of Florida showing details of construction, reinforcing and joints.
- B. Shop Drawings
 - 1. Content

- a. Shop layout, dimensions, and identification of each pre-cast unit corresponding to sequence and procedure of installation.
 - b. Estimated camber
 - c. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction openings in precast units.
 - d. Quantities, dimensions, and locations of sleeves, anchors, brackets, inserts, reglets, accessories, and methods of securing same in forms.
 - e. Casting, consolidating, and finishing procedures.
 - f. Other items cast into members
2. Show location of unit by same identification mark placed on member.
 3. Include design calculations.
- C. Manufacturer's Literature: Manufacturer's recommended installation instructions.
- D. Manufacturer's certificates of material conformance with specifications.
- E. Test Reports: Reports of tests on concrete.
- F. Testing
1. Certification: The supplier shall provide the certified results of testing (7 day, 28 day) for the test cylinders stated herein. Random test cylinders may be taken at any time by the ENGINEER at the OWNER's expense.

1.3 INSPECTION

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the ENGINEER, or other representatives of the OWNER. Such inspection may be made at the place of manufacture, or at the site after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the Specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All sections which have been damaged after delivery will be rejected, and if already installed, shall be repaired, if permitted and accepted by ENGINEER, or removed and replaced, entirely at the CONTRACTOR's expense.

- B. At the time of inspection, the sections will be carefully examined for compliance with ASTM C478 designation and these Specifications, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Imperfections may be repaired, subject to the approval of the ENGINEER, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days, Epoxy mortar may be utilized for repairs subject to the approval of the ENGINEER.

1.4 HANDLING, SHIPPING, AND STORAGE

- A. Transport, handle, and store pre-cast units in a manner that will prevent damage to the units. Units shall be handled such that the points of the support and direction of the reactions with respect to the unit are approximately the same during transportation and storage as when the unit is in the final position.
- B. Store units in a manner that will prevent cracking, distortion, staining, or other damage. Units shall be stored above-ground on skids or other supports to keep items free of dirt and other foreign debris.
- C. Units damaged by improper storage or handling shall be replaced or repaired to the satisfaction of the ENGINEER.

PART 2 – PRODUCTS

2.1 PRECAST CONCRETE STRUCTURES

- A. Precast submersible pump station wet wells shall consist of precast base, precast wet well sections, and top cover slab. Precast valve vaults shall consist of precast sidewalls and top slab. Precast building may be a single piece delivered in sections. Concrete shall be air entrained at the time of delivery and shall have a minimum compressive strength of 4,000 psi at the end of 28 days.
- B. Maximum total chloride ion content contributed from all ingredients of concrete including water, aggregates, cement, and admixtures measured as a weight percent of cement shall not exceed 0.06.
- C. Joints between precast concrete sections shall be set by plastic shims and fitted with non-metallic non-shrink grout as shown on the drawings.

- D. The top slab sections shall be fitted with watertight hatches. The frames and covers will be sized for the openings shown on the drawings.
- E. The various precast sections should have the inside dimensions and minimum thickness of concrete as indicated on the drawings. All precast and cast-in-place concrete members shall conform to the Building Code Requirements for Reinforced Concrete ACI 318.
- F. A vent pipe shall be furnished and installed as shown on the drawings.
- G. Fillets shall be provided and installed in the wet wells as shown on the drawings.
- H. Anchors, Lift Devices, and Accessories: Provide concrete inserts, reglets, anchors, brackets, and fasteners as indicated or required for fabrication and installation work. All items shall be zinc-coated or galvanized. Contractor shall select the lift devices and shall be responsible for their performance and for any damage resulting from the use of faulty or inferior devices. Lift devices shall not be visible on exposed faces of pre-cast members. Provide a minimum of four for each unit.
- I. Precast structures shall be constructed to the dimensions as shown on the drawings and as specified in these Specifications. Repair or replace any unit which does not conform to the dimensions or structural standards shown on the Contract Drawings or specified herein, and which is not suitable for the use as determined by the ENGINEER.
- J. Type II cement shall be used except as otherwise approved.
- K. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
- L. Sections shall be cured by an approved method and shall not be shipped until the minimum 7-day compressive strength has been attained.
- M. Each precast section manufactured in accordance with the drawings shall be identified, in a semi-permanent manner, at the precasting yard with respect to the final location. Locate such identification and make it of such material as to withstand wear during shipping and damage from the elements for a period of not less than one year. Protect and preserve identification marks and restore any identification which becomes damaged or partially obliterated. The ENGINEER reserves the right to reject any unit, and require replacement, if the identification becomes obliterated. CONTRACTOR shall be responsible for the installation of the correct pre-cast sections in their designated locations.
- N. Building exterior surface shall be treated as shown on the drawings.

2.2 PRECAST CONCRETE SECTIONS FOR WET WELLS

- A. Wet wells shall meet the requirements of ASTM C478, Specification for Precast Reinforced Concrete Manhole Sections, with the exclusion of Section 10(a), except as modified herein. Cement shall meet the requirements of ASTM C150-74, Specification for Portland Cement, Type II. Concrete shall meet the minimum requirement for 4000 psi concrete. Minimum wall thickness shall be 8 inches. The required minimum strength of concrete shall be confirmed by making and testing three standard cylinders at seven days. Rings shall be custom made with openings to meet indicated pipe alignment conditions and invert elevations. Submit shop drawings, consisting of manufacturers' standard details of various sections for approval prior to placing order for wet wells. Drawings of wet wells shall show invert elevations, pipe sizes and similar details.

- B. Joints

Form joint contact surfaces with machined castings. Surfaces shall be exactly parallel with nominal 1/16 inch clearing. An approved sealing compound (see LCU Approved Materials List) conforming to Federal Specification S-SS-210 (GSA-FSS), Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints must be used.

2.3 PIPE CONNECTIONS AT STRUCTURES

- A. Where pipes are to extend into or through structures from the exterior, flexible connections (mechanical or push-on type joints) shall be provided at the exterior wall face.
- B. For pipes passing through structural walls, wall pipes with water stops shall be installed where the location is below the surface of the ground or at any point where fluid levels will exceed that elevation. Neoprene sleeves with watertight caulking and 316 Series SS stainless steel clamps will be suitable at other locations.

PART 3 EXECUTION

3.1 INSTALLATION

- A. The CONTRACTOR shall be responsible for control of ground water to provide firm, dry subgrade for the structure, shall prevent water rising on new poured in place concrete or grouted joint sections within 24 hours after placing, and shall guard against flotation or other damage resulting from ground water or flooding.

- B. A minimum of a 12 inch layer of crushed stone or shell as specified under Section 31 23 23 shall be placed as a foundation for the wet well base slabs, valve vaults, and meter pits.
- C. Backfill material around the wet well and above the pipe bedding shall be selected material as specified in Section 31 23 23.
- D. Precast bases, conforming to all requirements of ASTM C478 and above listed requirements for precast sections, may be used. The base shall be set in place on a thoroughly compacted crushed stone sub-base and adjusted in grade for the correct structure elevation.
- E. The station shall not be set into the excavation until the installation procedure and excavation have been approved by the ENGINEER.
- F. The base may be cast-in-place concrete as specified in Division 3, placed on a thoroughly compacted crushed stone sub-base. The tops of the cast-in-place bases shall be shaped to mate with the precast barrel section and shall be adjusted in grade so that the top slab section is at the approximately correct elevation.
- G. Precast concrete structure sections shall be set so as to be vertical and with sections in true alignment with a 1/4 inch maximum tolerance to be allowed. The outside and inside joint shall be filled with a non-shrink grout and finished flush with the adjoining surfaces. Allows joints to set for 24 hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If leaks appear in the structures, the inside joints shall be caulked with lead wool to the satisfaction of the ENGINEER. Install the precast sections in a manner that will result in a watertight joint.
- H. Holes in the concrete sections required for handling or other purposes shall be plugged with a non-shrinking grout or by grout in combination with concrete plugs.
- I. Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done by core drilling prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.

END OF SECTION

SECTION 05 40 00
COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

- A. Extent of light-gauge framing is shown on Architectural and Structural drawings.
- B. Types of light-gauge metal framing units include the following:
 - 1. "C" shaped stud and track sections.
 - 2. Angles.
 - 3. Other shapes required.
- C. This section applies to exterior wall and soffit framing. See other sections for interior partition wall framing.

1.3 QUALITY ASSURANCE:

- A. Component Design: Compute structural properties of studs and joists in accordance with AISC "Specification for Design of Cold-Formed Steel Structural Members."
- B. Allowable Tolerance: See drawing general notes for allowable tolerances.
- C. Maximum Deflection: Manufacturer approved product data or design calculation to meet height and load conditions with maximum lateral deflection of wall studs due to wind load of L/240 for stud only and L/360 for composite stud and sheathing.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's product information and installation instructions for each item of light-gauge framing and accessories. Submit

manufacturer approved span deflection tables or design calculations prepared by a Professional Engineer licensed in the State of Florida to indicate that all light-gauge metal framing members satisfy the requirements of paragraph 1.3 above.

- B. Shop Drawings: Submit shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data.
 - 1. Include placement drawings for framing members showing size and gauge designations, number, type, location and spacing. Indicate supplemental strapping, bracing, splices, accessories, and details required for proper installation.
 - 2. Design of light-gauge metal framing shall be performed by a Licensed Structural Engineer in the state of Florida. Design calculations signed and sealed by the light-gauge steel design Engineer of Record shall be submitted for approval.
 - 3. Light-gauge metal framing shop drawings shall be submitted to the Structural Engineer of Record for approval prior to fabrication showing wall sections coordinated with drawings showing framing, accessories, anchorage, and connection details.

1.5 DELIVERY AND STORAGE:

- A. Protect metal framing units from rusting and damage. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off ground in a dry ventilated space or protect with suitable waterproof coverings.

PART 2 - PRODUCTS

2.1 METAL FRAMING:

- A. System Components: With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for applications indicated as needed to provide a complete metal framing system.
- B. Materials and Finishes:
 - 1. For 16 gauge and heavier galvanized units, fabricate metal framing

components of structural quality steel sheet with a minimum yield point of 50,000 psi, meeting requirements of ASTM A653, Structural Quality, Grade 50.

2. For 18 gauge and lighter galvanized units, fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi; ASTM A653, Structural Quality, Grade 33. Components shall be a minimum of 20 gauge.
3. Provide galvanized finish to metal framing components complying with **ASTM A924 for minimum G90 coating.**
 - a. Manufacturer: Subject to compliance with requirements, provide "C" shaped, load bearing steel studs of one of the following: Minimum 20 gauge or heavier gauge as required by the loading.
 1. Alabama Metal Industries Corp
 2. Allied Structural Industries
 3. Bostwick Steel Framing Co.
 4. Clark Steel Framing
 5. Dale/Incor
 6. Inryco/Milcor
 7. Monex Corp.
 8. Unimast, Inc.
 9. Wheeling Corrugating Co.

2.2 FABRICATION

- A. General: Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion.
- B. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.
- C. Wire tying of framing components is not permitted.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Manufacturer's Instructions: Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations, unless

otherwise indicated.

B. Runner Tracks: Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Secure tracks as recommended by stud manufacturer for type of construction involved, except do not exceed 24" o.c. spacing for nail or power-driven fasteners, or 16" o.c. for other types of attachment. Provide fasteners at corners and ends of tracks. All interior studs shall be supported at top of wall by deep leg tracks to allow for 3/4" vertical deflection. Do not screw studs to tracks.

C. Studs:

1. Install studs plumb, except as needed for diagonal bracing or required for non-plumb wall or warped surfaces and similar requirements.
 - a. Attach studs to top and bottom runner tracks by either welding or by self-drilling screws as defined below at both inside and outside flanges.
 - b. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
2. Axially loaded studs shall be installed in a manner which will assure that their ends are positioned tight against the inside runner webs prior to fastening.
 - a. Provide weak-axis horizontal bracing at 48 inches maximum vertical spacing, both stud flanges.
 - b. Weld or screw bracing at each intersection.
3. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions.
 - a. Install runner tracks and jack studs above and below wall openings.
 - b. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of wall.
 - c. Load bearing headers required over openings in bearing walls. Header members must be capable of transferring both vertical and horizontal loads to jamb and jack studs.
 1. Headers supporting roof members must be designed for resistance of required net uplift loads.
 2. Header members require web stiffeners at end bearing conditions. Header or stiffeners must be designed to resist web crippling at concentrated loads.

D. Install supplementary framing, blocking and bracing in metal framing system

wherever walls, partitions and joists are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

- E. Frame both sides of expansion and control joints with a separate stud; do not bridge the joint with components of stud system. See gypsum wall specifications for spacing of control joints.
- F. Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 4'-0" o.c.. Fasten at each intersection.
- G. Field Painting: Touch-up shop-applied protective coatings damaged during handling and installation. Use galvanizing repair paint for galvanized surfaces.

END OF SECTION 05 40 00

(NO TEXT FOR THIS PAGE)

SECTION 05 56 00

METAL CASTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Miscellaneous ferrous and nonferrous castings.

1. This classification includes wheel guards, valve vaults, manhole frames and covers, manhole steps, stop plank grooves, brackets and supports for piping and gutter inlets, floor drains, cleanouts and special malleable iron castings and inserts.
2. Provide and install aluminum access door(s) for concrete utility box(es), valve vaults, and wet wells as indicated on the Construction Drawings.
3. The Contractor shall furnish and install aluminum access door(s) with the following specifications:
 - a. Hatch must be designed for periodic water loading.
 - b. Lids constructed of ¼-inch thick diamond pattern aluminum plate.
 - c. All hinges and attaching hardware to be construction of 316 stainless steel.
 - d. Stainless steel slam lock with removable key.
 - e. Auto-lock T-316 stainless steel hold-open arm with release handle.
 - f. Single leaf construction.
 - g. Stainless steel compression spring assist.
 - h. H-20 load rating.
 - i. Recessed lifting handle.
 - j. Hatch shall be Halliday Products Model H1R3636 or approved equal.

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM A 27/A27M - Specification for Steel Castings, Carbon for General Applications
2. ASTM A 47 - Specification for Ferric Malleable Iron Castings
3. ASTM A 48 - Specifications for Gray Cast Iron Castings

4. ASTM A 148/A148M - Specifications for Steel Castings
5. ASTM A 536 - Specifications for Ductile Iron Castings
6. ASTM B 26/B26M - Aluminum-Alloy Sand Castings
7. ASTM B 148 - Aluminum Bronze Sand Castings
8. ASTM B 138 - Manganese Bronze

PART 2 PRODUCTS

2.1 WORKMANSHIP

- A. Provide castings accurately made to the approved dimensions, and plane or grind castings where marked or where otherwise necessary to secure flat and true surfaces. Make allowance in the patterns so that the specified thickness is not reduced. Provide manhole covers which conform to the details shown and which are true and seat at all points. Supply castings showing the name of the manufacturer and the country of manufacture. No plugging or welding of defective castings will be permitted.

2.2 WEIGHTS

- A. Reject castings with a weight which is less than the theoretical weight based on required dimensions by more than 5 percent. Provide facilities at the site for weighing castings in the presence of the ENGINEER, or furnish invoices showing true weights, certified by the supplier.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Erect all castings to accurate grades and alignment, and when placing in concrete carefully support castings to prevent movement during concreting.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes wood grounds, nailers, blocking and structural plywood where shown on the drawings. NOTE: Contractor to provide wood blocking at all hollow metal frames in metal stud walls.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 6, Section 06 41 00 - INTERIOR ARCHITECTURAL WOODWORK for interior woodwork specially fabricated for this project.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1) Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials

comply with requirements. Indicate type of preservative used and net amount of preservative retained.

- 2) Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
- 3) For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
- 4) For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- 5) Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- 6) Construction adhesives.

C. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
3. Warranty of chemical treatment manufacturer for each type of treatment.

1.5 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 panels. Provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wood-Preservative-Treated Materials:
 - a. Baxter: J. H. Baxter Co.
 - b. Chemical Specialties, Inc.
 - c. Continental Wood Preservers, Inc.
 - d. Hickson Corp.
 - e. Hoover Treated Wood Products, Inc.
 - f. Osmose Wood Preserving, Inc.

2.2 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by American Lumber Standard Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - 1. SPIB - Southern Pine Inspection Bureau.
 - 2. WWPA - Western Wood Products Association.
 - 3. NELMA - Northeastern Lumber Manufacturers Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

- D. 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.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
- E. Provide wood products manufactured without urea formaldehyde.

2.3 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.
 - 1. Do not use chemicals containing chromium or arsenic.
- B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing members less than 18 inches above grade.
 - 4. Wood floor plates installed over concrete slabs directly in contact with earth.
- C. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft.
- D. 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.

2.4 DIMENSION LUMBER

- A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
- B. Framing: Provide No. 2 Grade Southern Pine - SPIB or Douglas fir south-WWPA, unless otherwise indicated on drawings.

2.5 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of Southern pine-SPIB or Douglas fir south-WWPA, unless otherwise indicated.

2.6 PLYWOOD, GENERAL

- A. Plywood Panel Standard: Provide plywood panels complying with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood."
- B. Trademark: Factory mark plywood panels with APA trademark evidencing compliance with grade requirements.

2.7 CONCEALED, PERFORMANCE-RATED PLYWOOD PANELS

- A. General: Where plywood panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable).

1. Thickness: Provide plywood panels meeting requirements specified but not less than thickness indicated.
 2. Span Ratings: Provide plywood panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial."
- B. Subflooring: APA-rated sheathing.
1. Exposure Durability Classification: Exposure 1.
 2. Span Rating: As required to suit joist spacing indicated.

2.8 PLYWOOD PANELS FOR BACKING

- A. Plywood Backing Panels: for use as backing panels for mounting electrical, data, or telephone equipment, coated with intumescent paint.

2.9 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A153 or of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO National Evaluation Report NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers.

2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

- B. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum 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.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.
 - 2. "Recommended Nailing Schedule" of referenced framing standard and with AFPA's "National Design Specifications for Wood Construction." Comply with requirements of applicable codes and of authorities having jurisdiction.
- F. Use hot-dip galvanized 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 tight connections between members. Install fasteners without splitting wood; predrill as required.
- G. Countersink nail heads on exposed carpentry work and fill holes.

3.2 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.

3.3 WOOD FRAMING, GENERAL

- A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- B. Install framing members of size and at spacing indicated.
- C. Do not splice structural members between supports.
- D. Firestop concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where firestopping is not inherent in framing system used, provide closely fitted wood blocks of 2-inch nominal-thickness lumber of same width as framing members.
- E. Provide 2X Pressure Treated wood blocking at ALL hollow metal frames in metal stud frame walls.

3.4 INSTALLATION OF PLYWOOD PANELS

- A. General: Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial," for types of plywood panels and applications indicated.
 - 1. Comply with "Code Plus" provisions of above-referenced guide.
- B. Fastening Methods: Fasten plywood backing panels by nailing or screwing to supports.

END OF SECTION 06 10 00

SECTION 06 16 00

SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Wall sheathing.
 2. Building paper.
 3. Building wrap.
 4. Nailbase Insulation
 5. Sheathing joint-and-penetration treatment.
 6. Flexible flashing at openings in sheathing.

1.2 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.
- B. Research/Evaluation Reports: For the following indicating compliance with the Florida Building Code:
1. Preservative-treated plywood.
 2. Foam-plastic sheathing.
 3. Building wrap.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Plywood.
2. Oriented strand board.
3. Particleboard underlayment.
4. Hardboard underlayment.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: DOC PS 1.

2.2 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA C9.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

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

2.3 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M. DENSglas

1. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.

2.4 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

- A. 5/8" CD Plywood-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation with oriented strand board laminated to one face complying with ASTM C 1289, Type V.
 - 1. Polyisocyanurate-Foam Thickness: 4 inches (102 mm).
 - 2. Plywood Nominal Thickness: 5/8" inch for use as deck at concrete tile roof.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated.
 - 1. For wall and roof sheathing panels, provide fasteners with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.6 WEATHER-RESISTANT SHEATHING PAPER

- A. Building Paper: ASTM D 226, Type 1 (No. 30 asphalt-saturated organic felt), unperforated.
- B. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 - 1. Products: Basis of Design: spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont™ Tyvek® CommercialWrap® and related assembly components. Other Products meeting requirements will be considered
 - 2. Performance Characteristics:
 - a. Air Penetration: 0.001 cfm/ft² at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ≤0.04 cfm/ft² at 75 Pa, when tested in accordance with ASTM E2357
 - b. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
 - c. Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test Method 127.
 - d. Basis Weight: 2.7 oz/yd², when tested in accordance with TAPPI Test Method T-410.

- e. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
- f. Tensile Strength: 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
- g. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
- h. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 10, Smoke Developed: 10.

B. Building-Wrap Tape: Tape recommended by building-wrap manufacturer.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric silicone joint sealant recommended by sheathing manufacturer.

B. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, and recommended by tape and sheathing manufacturers.

C. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, of type recommended by sheathing and tape manufacturers.

D. Sheathing Tape for Foam-Plastic Sheathing: Tape recommended by sheathing manufacturer.

2.8 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch (0.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Securely attach to substrate by fastening as indicated, complying with the following:

1. The Florida Building Code.
2. Manufacturers requirements.

3. For composite nailbase insulated sheathing provide manufacturers fastening patterns to comply with wind pressures indicated.

- B. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that exclude exterior moisture.
- C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 COMPOSITE NALBASE INSULATED SHEATHING

- A. General: Comply with manufacturers recommendations.
 1. Comply with "Code Plus" installation provisions in guide referenced in paragraph above.
- B. Fastening Methods: Fasten panels as indicated below:
 1. Screw to cold formed metal framing.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials.

3.4 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

- A. General: Cover sheathing with weather-resistant sheathing paper as follows:
 1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
 2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.
- B. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.

C. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.5 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed tape in sealant. Apply sealant to exposed fasteners. Seal other penetrations and openings.
3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.6 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
2. Lap flashing over weather-resistant building paper at bottom and sides of openings.
3. Lap weather-resistant building paper over flashing at heads of openings.
4. After flashing has been applied, roll surfaces with a hard rubber or metal roller.

3.7 PROTECTION

A. Protect materials as recommended by manufacturers.

END OF SECTION 06 16 00

SECTION 06 42 00

WOOD PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood veneer plywood paneling matching existing.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Grounds and concealed blocking.
- B. Section 09 91 13 - Exterior Painting: Field finishing.

1.03 REFERENCE STANDARDS

- A. AWI (QCP) - Quality Certification Program Current Edition.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.
- D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on fire-retardant treatment materials and application instructions.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide plan of panel number sequencing.
- D. Samples: Submit two samples of finished plywood, 12 X 12 inches in size, illustrating wood grain and specified finish.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
 - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 MOCK-UP

- A. Locate where directed.
- B. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 PANELING

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.
- B. Flat Paneling:
 1. Species: Match existing paneling on site..
 2. Cut: Match Existing on site..
 3. Panels: Veneer of full width and balanced sequence matched.
 4. Visible Edges and Reveals: Filled and painted.
 5. Outside Corners: Mitered and splined.

2.02 WOOD-BASED MATERIALS - GENERAL

- A. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless indicated otherwise, and provided it is clean and free of contamination, identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc. (ALSC).
- B. Hardwood Plywood: HPVA HP-1 Grade A; veneer core, type of glue recommended for application; of grain quality suitable for transparent finish.
- C. Lumber: Maximum moisture content of 6 percent; with vertical grain , of quality suitable for transparent finish.

2.03 ADHESIVES AND FASTENERS

- A. Adhesives: Type suitable for intended purpose, complying with applicable air quality regulations.

- B. Fasteners: Of size and type to suit application; finish in concealed locations and finish in exposed locations.

2.04 FABRICATION

- A. Prepare panels for delivery to site, permitting passage through building openings.
- B. Finish exposed edges of panels as specified by grade requirements.
- C. When necessary to cut and fit on site, provide materials with ample allowance for cutting and scribing.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Do not begin installation until wood materials have been fully acclimated to interior conditions.
- C. Set and secure materials and components in place, plumb and level, using concealed fasteners wherever possible.
- D. Touch up damaged finish to match original, using materials provided by fabricator; replace components that cannot be refinished like new.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.8 mm).

END OF SECTION 06 42 00

(NO TEXT FOR THIS PAGE)

SECTION 07 11 13 BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes cold-applied, asphalt emulsion and cold-applied, cut-back asphalt dampproofing.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified, including data substantiating that materials comply with requirements for each dampproofing material specified. Include recommended method of application, recommended primer, number of coats, coverage or thickness, and recommended protection course.
 - 0. Certification by dampproofing manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed bituminous dampproofing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

- B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from one source and by a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
- C. Contractor shall ensure that dampproofing materials where shown to be in contact, are compatible with the cavity wall insulation.

1.5 PROJECT CONDITIONS

- A. Substrate: Proceed with dampproofing only after substrate construction and penetrating work have been completed.
- B. Weather Limitations: Proceed with dampproofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements.
- C. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide trowel-grade, cold-applied asphalt dampproofing products by one of the following:
 - 0. ChemRex, Inc.; Sonneborn Building Products Div.
 - 1. Euclid Chemical Co.
 - 2. Karnak Chemical Corp.
 - 3. Koppers Industries, Inc.
 - 4. Lambert Corp.
 - 5. W.R. Meadows, Inc.

2.2 BITUMINOUS DAMPPROOFING

- A. General: Provide products recommended by manufacturer for designated application.
 - 1. Odor Elimination: For interior and concealed-in-wall uses, provide type of bituminous dampproofing material warranted by manufacturer to be substantially odor free after drying for 24 hours under normal conditions.
- B. Cold-Applied, Asphalt Emulsion Dampproofing: Asphalt-based emulsions recommended by manufacturer for dampproofing use when applied according to the manufacturer's instructions.
 - 1. Trowel Grade: Emulsified asphalt mastic, prepared with mineral-colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D1227, Type III or IV.
- C. Cold-Applied, Cut-Back Asphalt Dampproofing: Asphalt and solvent compound mixed to a smooth, uniform consistency to provide a firm, moisture-resistant, vapor-resistant, elastic coating recommended by the manufacturer for dampproofing use when applied according to the manufacturer's instructions.
 - 1. Trowel Grade: Asphalt roof cement, consisting of an asphalt base with petroleum solvents and mineral stabilizers, complying with ASTM D4586, Type I.
- D. Use products that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Asphalt primer complying with ASTM D41, for asphalt-based dampproofing.
- B. Glass Fabric: Woven glass fabric, treated with asphalt, complying with ASTM D1668, Type I.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.
- B. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.
- C. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at construction joints.
- D. Install separate flashings and corner protection stripping, as recommended by prime materials manufacturer, where indicated to precede application of dampproofing. Comply with details shown and with manufacturer's recommendations. Pay particular attention to requirements at building expansion joints, if any.
- E. Prime substrate as recommended by prime materials manufacturer.
- F. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work by masking or otherwise protecting adjoining work.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's recommendations except where more stringent requirements are indicated and where Project conditions require extra precautions to ensure satisfactory performance of work.
- B. Application: Apply dampproofing to the following surfaces:
 - 1. Exterior, below-grade surfaces of exterior concrete and masonry walls in contact with earth or other backfill and where space is enclosed on opposite side.
 - 2. Interior surface of concrete masonry from bottom to top of panel surface to prevent water-vapor penetration through the wall.

- C. Cold-Applied, Asphalt Dampproofing: Provide cut-back, asphalt dampproofing materials at below grade applications and emulsified, asphalt dampproofing materials at above grade applications, unless otherwise indicated.
- D. Reinforcement: At changes in plane or where otherwise shown as "reinforced," install lapped course of glass fabric in first coat of dampproofing compound before it thickens.
- E. Bituminous Cant Strips: Install 2-by-2-inch cant strip of bituminous grout at base of vertical dampproofing where it meets horizontal surface.
- F. Apply vertical dampproofing down walls from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when the Project is completed.

3.3 COLD-APPLIED, ASPHALT EMULSION DAMPPROOFING

- A. Trowel Grade: Trowel apply a coat of mastic asphalt emulsion dampproofing onto substrate at a minimum rate of 7 gal./100 sq. ft., to produce an average, dry-film thickness of 60 mils but not less than 30 mils at any point.

3.4 COLD-APPLIED, CUT-BACK ASPHALT DAMPPROOFING

- A. Trowel Grade: Trowel apply a coat of mastic asphalt dampproofing onto substrate at a minimum rate of 7 gal./100 sq. ft. to produce an average, dry-film thickness of 70 mils but not less than 30 mils at any point.

3.5 PROTECTION AND CLEANING

- A. Protect exterior, below-grade dampproofing membrane from damage until backfill is completed. Remove overspray and spilled materials from surfaces not intended to receive dampproofing.

END OF SECTION 07 11 13

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SECTION 07 19 00
UNDERSLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Slab sheet vapor barriers shall be provided on grade under all interior concrete floor slabs unless otherwise specified or indicated.
- B. Provide minimum 10 mil thick vapor barrier.

1.3 SUBMITTALS

- A. Manufacturer's Data: Include specifications, installation instructions and general recommendations from the manufacturer for the types of products required. Include manufacturer's certification or other data substantiating that the materials comply with the requirements.

1.4 JOB CONDITIONS

- A. Examine the substrate and the conditions under which the work is to be performed, and do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Proceed with work only after substrate construction is complete, all projections through barrier have been installed and immediate installation of concrete work over the vapor barrier can be performed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Minimum 15 mil vapor barrier:

a. Reef Industries "Griffolyn 10 Mil".

b. Stego Industries LLC "Stego Wrap (10 mil) Vapor

Barrier".

2.2 MATERIALS

A. Manufacturer's standard low-permeance polymer membrane, thickness as indicated for intended application.

B. Vapor barrier shall meet or exceed Class C (for 10 mil thickness) requirements as established by ASTM E1745.

C. Vapor barrier accessory materials including pipe boots, tapes and adhesives, shall be as recommended by the vapor barrier manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions and ASTM E1643 for the particular conditions of installation in each case. Clean substrate of projections and materials injurious to the vapor barrier. Level and tamp or roll granular base.

B. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete pour.

C. Lap vapor barrier over footings and seal to foundation walls, extending barrier up walls minimum 2 inches above the thickness of slabs. At thickened edge slabs, extend barrier under thickened edge and up to grade. Overlap joints six inches and seal with manufacturer's recommended pressure sensitive tape.

- D. Seal all penetrations, including pipes and conduits, with manufacturer's standard pipe boot and pressure sensitive tape. Exercise care to avoid punctures.

3.2 PROTECTION AND REPAIR OF VAPOR BARRIERS

- A. Protect vapor barrier from puncture, damage and deterioration. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged areas a minimum of six inches on all sides, and taping with pressure sensitive tape.

END OF SECTION 07 19 00

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SECTION 076100

SHEET METAL ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet metal Standing Seam Roofing, associated flashings, and underlayment.
- B. Counterflashings.
- C. Sealants for joints within sheet metal fabrications.
- D. Cement Board Sheathing

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- D. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications 2020a.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- F. ASTM B32 - Standard Specification for Solder Metal 2020.
- G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- I. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- J. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- K. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).

- L. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments 2012, with Editorial Revision (2015).
- M. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on metal types, finishes, characteristics.
- C. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- D. Installation Samples: Submit two samples in size illustrating metal roofing mounted on plywood backing illustrating typical seam.
- E. Color Samples: Submit two samples 6" by 6" inches in size illustrating metal finish color.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise noted.
 - 1. Maintain one copy on project site.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a 5-year period after Date of Substantial Completion. Defective work includes degradation of metal finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sheet Metal Roofing Manufacturers:
 - 1. Petersen Aluminum Corporation: www.pac-clad.com/#sle.

2. Sheffield Metals International; Aluminum: www.sheffieldmetals.com/#sle.
3. Substitutions: See Section 016000 - Product Requirements.

2.02 SHEET MATERIALS

- A. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 20-gauge, 0.032-inch minimum base metal thickness; plain texture; shop pre-coated with polyvinylidene fluoride (PVDF) coating, color as selected by Architect.
- B. Stainless Steel Sheet: ASTM A666, Type , soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 finish.

2.03 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Fabricate cleats of same material as sheet, thickness to match roofing sheet, and at least 2" wide, interlockable with sheet.
- C. Fabricate starter strips, interlockable with sheet.
- D. Form pieces in longest practical lengths.
- E. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- F. Form material with standing seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

2.04 FINISHES

- A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
- B. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
- C. Color: As selected by Architect from manufacturer's standard colors.
- D. Primer Coat: On coated sheets, finish concealed side of sheet with primer compatible with finish system as recommended by finish system manufacturer.

2.05 CEMENT ROOF BOARD SHEATHING

- A. Basis of Design: DEXcell® Cement Roof Board by PermaBASE Building Products, LLC provided by National Gypsum Company
 1. Physical Characteristics
 - a. Core: Moisture and mold cementitious core resistance to mold growth on the board per ASTM D 3273.
 - b. Surfacing: Fiberglass mesh with reinforced edges

- c. Overall thickness: 7/16 inch
 - d. Board conforms with requirement of ASTM C 1325
 - e. Minimum Flexural Strength: 1000 per ASTM C 947
 - f. Flute Spanability: 12 inches when tested in accordance with ASTM E 661
 - g. Compressive Strength, Nominal: 1250 psi
 - h. Permeance: Minimum 10 perms when tested in accordance with ASTM E 96, Dry cup method
 - i. Meets FM Class 1 and UL Class A fire rating for roofing systems up to unlimited slope per UL 790
 - j. Classified in roof deck construction in accordance with ANSI/UL 1256.
- B. FLAME SPREAD/SMOKE DEVELOPED: 0/0 IN ACCORDANCE WITH ASTM E 84

2.06 ACCESSORIES

- A. Fasteners: Stainless steel, with soft neoprene washers.
- B. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
 - 1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
 - 2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 - 3. Ultraviolet Resistance and Weatherability: Approved in writing by manufacturer for exposure to weather for minimum of 12 months.
 - 4. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
 - 5. Fasteners: Stainless Steel as specified by manufacturer and building code qualification report or approval, if any.
- C. Roofing Underlayment Manufacturers: On all surfaces to be covered with roofing material, furnish and install a 40 mil Peel & Stick membrane, required as outlined by metal panel manufacturer. Membrane to be a minimum of 40 mil thickness, smooth, non-granular, high temperature.
 - 1. Basis of design: Carlisle WIP 300 HT High Temperature Protection Self Adhering Roofing Underlayment. Other acceptable manufacturers include:
 - a. W.R Grace "Ice & water Shield"
 - b. Interwrap Titanium PSU-30
 - c. Tamko TW Tile and Metal Underlayment
 - d. Underlayment shall be laid in horizontal layers with joints lapped

toward the eaves a minimum of 6, and well secured along laps and at ends as necessary to properly hold the felt in place. All underlayment shall be preserved unbroken and whole.
Concealed Sealants: Non-curing butyl sealant.

- E. Exposed Sealants: ASTM C920 elastomeric sealant, with minimum movement capability as recommended by manufacturer for sealed substrates; color to match adjacent material.
 - 1. Manufacturers:
 - a. See Section 079200 Joint Sealants
 - b. Substitutions: See Section 016000 - Product Requirements.
- F. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.
- G. Reglets: Surface-mounted type, same material as roofing sheets; face and ends covered with plastic tape.
- H. Solder: ASTM B32; Sn50 (50/50) type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.
- B. Verify deck is dry and free of snow or ice. Verify joints in wood deck are solidly supported and fastened.
- C. Verify correct placement of wood nailers and insulation positioning between nailers.
- D. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips located.
- E. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION - ROOFING

- A. Apply underlayment over entire roof area.
- B. Apply slip sheet in one layer, laid loose.
- C. Cleat and seam all joints.

- D. Use roof cement for joints between metal and bitumen for joints between metal and felts.

3.04 INSTALLATION - STANDING SEAM ROOFING

- A. Comply with SMACNA (ASMM) details for standing seams figures 8, 9 and 10.
- B. Space batten seams at 20" on center.
- C. Lay sheets with long dimension perpendicular to eaves. Apply pans beginning at eaves.
- D. Lock cleats into seams and flatten.
- E. Stagger transverse joints of roofing sheets.
- F. At eaves and gable ends, terminate roofing by hooking over edge strip.
- G. Finish standing seams 1 inch high on flat surfaces
- H. Bend up one side edge 1-1/2 inches and other edge 1-3/4 inches.
- I. Make first fold 1/4-inch wide single fold and second fold 1/2 inch wide, providing locked portion of standing seam, five plies in thickness.
- J. Fold lower ends of seams at eaves over at 45 degree angle.

3.05 INSTALLATION - STANDING SEAM ROOFING

- A. Comply with SMACNA (ASMM) details.
- B. Space seams 16" on center.
- C. Turn up sides of sheets and extend 1/2 inch above top of battens.
- D. Apply pans beginning at eaves.
- E. Stagger transverse joints of roofing sheets.
- F. Form cross seams with 3/4-inch fold-under on lower end and 2-inch fold on upper end; slit folds in cross seams at each corner, 1 inch in from batten to form tab; hook fold on lower end of pan into fold on upper end of underlaying pan.
- G. Place cover strips over seams, locking edges with flanges of pan malleted down against sides of battens, and cover batten ends with cap folded and locked into extensions of batten covers and vertical legs of pans.
- H. At intersection of roof slope with ridge and hip battens, turn up edges of roof pans against battens, and terminate in 1/2-inch flange at top of battens and install cover strips.
- I. Form valleys of sheets not exceeding 10 feet in length, and lap joints 6 inches in direction of drainage.
- J. Extend valley sheet minimum 6 inches under roofing sheets.

- K. At valley, double fold valley and roofing sheets and secure with cleats spaced 18 inches on center.
- L. At eaves, hook pan over edge strip and extend edge strip up under metal roofing 4 inches and secure with nails at 4 inches on center, at 1 inch from upper end.

3.06 INSTALLATION - FLASHINGS

- A. Comply with SMACNA (ASMM) details.
- B. Insert flashings into reglets to form tight fit.
 - 1. Secure in place with lead wedges at maximum 24" on center. Pack remaining spaces with lead wool.
 - 2. Seal flashings into reglets with sealant.
- C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- D. Cleat and seam each joint.
- E. Apply roof cement compound between metal flashings and felt flashings.
- F. Fit flashings tight in place, and make corners square, surfaces true and straight in planes, and lines accurate to profiles.
Seal metal joints watertight.

3.07 PROTECTION

- A. Do not permit traffic over unprotected roof surface.

END OF SECTION 076100

(NO TEXT FOR THIS PAGE)

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes sheet metal flashing and trim including but not limited to the following:
 - 1. Exposed trim and fascia.
 - 2. Metal flashing.
 - 3. Miscellaneous sheet metal accessories.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 4, Section 04 20 00 - UNIT MASONRY for through-wall flashing and other integral masonry flashings specified as part of masonry work.
 - 2. Division 7, Section 07 52 00 – DECK MEMBRANE SYSTEM for flashing and roofing accessories installed integral with roofing membrane as part of roofing-system work.
 - 3. Division 7, Section 07 92 00 - JOINT SEALANTS for elastomeric sealants.

1.3 PERFORMANCE REQUIREMENTS

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

1.4 SUBMITTALS

- A. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
- B. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed sheet metal 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.

1.6 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

2.1 METALS

- A. Stainless Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; 4 polished directional satin finish.

2.2 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).

2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Burning Rod for Lead: Same composition as lead sheet.
- B. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- B. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.
- C. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- D. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7, Section 07 92 00 – JOINT SEALANTS.
- E. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by roofing manufacturer for exterior and interior nonmoving joints, including riveted joints.
- F. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.
- G. Paper Slip Sheet: 5-lb/square red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.
- H. Polyethylene Underlayment: ASTM D 4397, minimum 6-mil-thick black polyethylene film, resistant to decay when tested according to ASTM E 154.
- I. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

- J. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

2.3 FABRICATION, GENERAL

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
- B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal. Shop-fabricate work to the greatest extent possible.
- C. Form exposed sheet metal 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.
- D. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- E. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches 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 inch deep, filled with mastic sealant (concealed within joints).
- F. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- G. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.
- H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

- I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
 - 1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.4 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

- C. Splash Pans: Fabricate from Stainless Steel sheet, 24 GA.
- D. Roof-Penetration Flashing: Fabricate from lead, 4.0 lb/sq. ft., hard tempered.
- F. Exposed Trim and Fascia: Stainless Steel sheet, 24 GA.
- G. Copings: Fabricate from Stainless Steel sheet, 24 GA.
- H. Base Flashing: Fabricate from Stainless Steel sheet, 26 GA.
- I. Flashing at Masonry Cavity Wall: Fabricate from Stainless Steel sheet, 26 GA. Type 304.
- I. Counterflashing: Fabricate from Stainless Steel sheet, 26 GA.
- J. Flashing Receivers: Fabricate from Stainless Steel sheet, 26 GA.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which sheet metal 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.

3.2 INSTALLATION

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
- B. Install exposed sheet metal 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 sheet metal 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 sheet metal.
- C. Expansion Provisions: Provide for thermal expansion of exposed sheet metal work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches 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 inch deep, filled with mastic sealant (concealed within joints).
- D. 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.
- E. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- F. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
 - 1. Bed flanges of work in a thick coat of roofing cement where required for waterproof performance.
- G. 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 inches and bed with sealant.

- I. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:
 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 2. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

3.3 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 sheet metal flashing and trim work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 07 62 00

(NO TEXT FOR THIS PAGE)

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes joint sealants for the following locations:
 - 1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints between different materials.
 - d. Perimeter joints between materials and frames of doors and windows.
 - e. Control and expansion joints in ceiling and overhead surfaces.
 - f. Other joints as indicated.
 - 2. Exterior joints in horizontal traffic surfaces as indicated below:
 - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
 - b. Joints between different materials.
 - c. Other joints as indicated.

3. Interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - d. Other joints as indicated.
 4. Interior joints in horizontal traffic surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete slabs.
 - c. Other joints as indicated.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 7, Section 07 62 00 - SHEET METAL FLASHING AND TRIM for sealing joints related to flashing and sheet metal for roofing.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data from manufacturers for each joint sealant product required.

- C. Samples for Initial Selections: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use intended.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F.
 - 2. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

1.9 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- C. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this section within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.
- D. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 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 selections made by Architect from manufacturer's full range of standard colors for products of type indicated.
- C. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Nonmembrane Roof Sealants: 300 g/L.
 3. Single-Ply Roof Membrane Sealants: 450 g/L.
 4. Sealant Primers for Nonporous Substrates: 250 g/L.
 5. Sealant Primers for Porous Substrates: 775 g/L.
 6. Modified Bituminous Sealant Primers: 500 g/L.

2.2 ELASTOMERIC JOINT SEALANTS

- A. Urethane Sealant: Provide manufacturer's standard polyurethane sealants that comply with ASTM C920 and requirements indicated.
- B. Additional Movement Capability: Where additional movement capability is specified, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.

- C. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for project.
- D. Single-Component Nonsag Urethane Sealant: Comply with the following:
1. Type: S (single component).
 2. Grade: NS (nonsag).
 3. Class: 25, with movement capability of 25 percent extension and 25 percent compression.
 4. Use: NT (nontraffic), M, A and 0 as per ASTM C920.
 5. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Vulkem 116," RPM International, Inc.
 - b. "Dynatrol 1," Pecora Corp.
 - c. "Sikaflex - 1a," Sika Corp.
 - d. "Sonolastic NP-1," Sonneborn Building Products Div.
 - e. "Dymonic", Tremco, Inc.
- E. Single-Component Silicone Sealant: Comply with the following:
1. Type: S (single component).
 2. Grade: NS (nonsag).
 3. Class: 25, with movement capability of 25 percent extension and 25 percent compression.
 4. Use: NT (nontraffic), M, G, A and O as per ASTM C920.
 5. Products: Subject to compliance with requirements, provide one of the following:

- a. "791" Dow Corning.
- b. "Spectrum 2" Tremco, Inc.
- c. "Pecora 864 Architectural Silicone Sealant" Pecora Corp.
- d. "Silpruf" General Electric.
- e. "Omniseal" Sonneborn Building Products Div.

2.3 LATEX JOINT SEALANTS

- A. General: Provide manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.
- B. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.
- C. Products: Subject to compliance with requirements, provide one of the following:
 1. Acrylic-Emulsion Sealant:
 - a. "AC-20," Pecora Corp.
 - b. "Sonolac," Sonneborn Building Products Div., ChemRex, Inc.
 - c. "Tremco Acrylic Latex 834," Tremco, Inc.

2.4 TAPE SEALANTS

- A. Tape Sealant: Manufacturer's standard, solvent-free, butyl-based tape sealant with a solids content of 100 percent formulated to be nonstaining, paintable, and nonmigrating in contact with nonporous surfaces with or without reinforcement thread to prevent stretch and packaged on rolls with a release paper on one side.

B. Products: Subject to compliance with requirements, provide one of the following:

1. "Extru-Seal Tape," Pecora Corp.
2. "Shim-Seal Tape," Pecora Corp.
3. "PTI 606," Protective Treatments, Inc.
4. "Tremco 440 Tape," Tremco, Inc.
5. "MBT-35," Tremco, Inc.

2.5 JOINT SEALANT BACKING

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

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

C. 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.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint

substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 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, 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.

3.3 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.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. 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.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
 - 2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

- D. 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.
- E. Tooling of Nonsag 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.

3.4 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.

3.5 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 and installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

(NO TEXT FOR THIS PAGE)

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal work.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

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

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.

- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ceco Door Products; an Assa Abloy Group company.
 - 2. Curries Company; an Assa Abloy Group company.
 - 3. Greensteel Industries, Ltd.
 - 4. Republic Doors and Frames.
 - 5. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and **provide permanent engraved metal label** by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings[and temperature-rise limits] indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and **provide permanent engraved metal label** for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and **provide permanent engraved metal label** by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. All locations.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 3. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
 - b. Construction: Full profile welded.
 - 4. Exposed Finish: Prime .

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. All Locations.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.

- e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
3. Frames:
- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 088000 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral- fiber insulation.
 - 2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 - 3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 - 4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
 - 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors

- against water penetration.
6. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive non-templated, mortised, and surface- mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

3. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered joints. View panel frames shall be fabricated from 16-gage, cold-rolled steel with fully welded corners ground smooth.
4. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
5. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
6. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
7. Provide loose stops and moldings on inside of hollow-metal work. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions

detrimental to performance of the Work.

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

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating (15 mil. Dry film Thickness) to backs of frames that will be filled with grout containing anti-freezing

agents\ (i.e. ALL exterior frames). The inside of all frames in exterior and masonry walls shall be fully grouted and **the insides of the frames shall be coated with a bituminous damproofing coating. Coating shall be furnished and field applied by the Contractor to a minimum of 60 mil thickness.**

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post installed expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of post installed expansion anchors if so indicated and approved on Shop Drawings.
3. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch +/- 1/32 inch.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes aluminum window for single exterior locations.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
- B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
 - 1. Include similar Samples of hardware and accessories involving color selection.
- D. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:
 - 1. Exposed Finishes: 2 by 4 inches.
 - 2. Exposed Hardware: Full-size units.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.
- B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.6 WARRANTY

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

Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer Series 5500 Thermal Fixed, or **comparable** product by one of the following:
 - 1. TRACO.
 - 2. Winco.
 - 3. YKK AP America Inc.

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

2.2 WINDOW PERFORMANCE REQUIREMENTS

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

- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Grade: "Architectural".

- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.28 Btu/sq. ft. x h x deg F.

- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.27.

- E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 69.

- F. Windborne-Debris Resistance: Capable of resisting impact from windborne debris based on testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction. **Design wind velocity for 170 mph. Missile impact protection: Passive, with impact glass.**

2.3 ALUMINUM WINDOWS

- A. Operating Types: Provide the following operating types in locations indicated on Drawings:
 - 1. Fixed.
- B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
 - 1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
- C. Glass: Tinted laminated glass with two plies of heat-strengthened float glass and fully tempered float glass where indicated with outer ply Class 2 (tinted) and inner ply Class 1 (clear)
- D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- E. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
 - 1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
- F. Fasteners :Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

- A. Subsills: Nonthermal, extruded-aluminum subsills in configurations

indicated on Drawings.

- B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- C. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

2.5 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Glaze aluminum windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- F. Window Assemblies: Provide fixed units in configuration indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
 - 1. Angled mullion posts with interior and exterior trim.
 - 2. Angled interior and exterior extension and trim.
 - 3. Exterior head and sill casings and trim.
- G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

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

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
 - 1. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Aluminum Finish: Class I, Clear Anodic Finish; AA-M21C22A42/A49; complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

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

3.3 ADJUSTING, CLEANING, AND PROTECTION

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

END OF SECTION 08 51 13

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SECTION 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes fixed, extruded-aluminum louvers.
- B. Related sections include the following:
 - 1. Division 7, Section 07 92 00 - JOINT SEALANTS for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 8, Section 08 11 13 - STEEL DOORS AND FRAMES

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this section, unless otherwise defined in this section or in referenced standards.
- B. Standard Free Area: Free area of a louver 48 inches wide by 48 inches high, identical to that provided.
- C. Maximum Standard Airflow: Airflow at point of beginning water penetration through a louver 48 inches wide by 48 inches high, identical to that provided.
- D. Drainable-Blade Louver: Louver designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide exterior metal louvers capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.
 - 1. Wind Load: Uniform pressures (velocity pressures) indicated on Drawings, acting inward or outward. Special criteria for louvers in the Enhanced Hurricane Protection Area (EHPA) are specified in this section.
 - 2. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, and other detrimental effects:
 - a. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.
- B. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units 48 inches wide by 48 inches high. Test units according to AMCA 500.
 - 1. Perform testing on unpainted, cleaned, degreased units.
 - 2. Perform water-penetration testing on louvers without screens.

1.5 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Shop Drawings: For louver units and accessories. Include plans; elevations; sections; and details showing profiles, angles, and spacing of louver blades. Show unit dimensions related to wall openings and construction; free area for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

1. For installed louvers and vents indicated to comply with design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Product Certificates: Signed by manufacturers of louvers certifying that the products furnished comply with requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with AMCA's Certified Ratings Program.

1.6 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer, registered in the State of Florida, who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of louvers that are similar to those indicated for this project in material, design, and extent.
- B. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where alike in one or more respects regarding type, design, or factory-applied finish.
- C. Welding Standards: As follows:
 1. Comply with AWS D1.2, "Structural Welding Code--Aluminum."
 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- D. SMACNA Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: (Basis of Design) "Greenheck". Subject to compliance with requirements, products by the following are acceptable:
1. Airolite Co.
 2. All-Lite Louver Co.
 3. American Warming and Ventilating, Inc.
 4. Construction Specialties, Inc.
 5. Ruskin Manufacturing; Tomkins Industries, Inc.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B221, alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B26, alloy 319.
- D. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
1. Use types and sizes to suit unit installation conditions.
 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- E. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.
- F. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D1187.

2.3 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less. At horizontal joints between louver units, provide horizontal mullions, unless continuous vertical assemblies are indicated.
- G. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.
- H. Join frame members to one another and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view; unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.
- I. Compression Weatherstripping: Manufacturer's standard replaceable compressible weatherstripping gaskets of molded neoprene complying with ASTM D2000 or molded PVC complying with ASTM D2287.
- I. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 FIXED, EXTRUDED ALUMINUM LOUVERS

- A. Louver Construction: Provide fixed-blade louvers with extruded-aluminum frames and blades.

- B. Horizontal, Drainable-Blade Louvers: As follows:
1. Louver Depth: 4 inches, unless otherwise indicated.
 2. Frame and Blade Thickness: 0.081 inch.
 3. Blade Angle and Spacing: 45 degrees and 4 inches o.c. for 4-inch-deep louvers.
- C. Continuous, Horizontal, Drainable-Blade Louvers: Fabricated with close-fitting, field-made splice joints in blades designed to permit expansion and contraction without deforming blades or framework and with mullions recessed from front edges of blades so blades have continuous appearance.
1. Louver Depth: 4 inches, unless otherwise indicated.
 2. Frame and Blade Thickness: 0.081 inch.
 3. Blade Profile: Drainable blade.
 4. Blade Angle and Spacing: 45 degrees and 5 inches o.c. for 4-inch-deep louvers.
 5. Exterior Corners: Prefabricated corner units with mitered and welded blades aligned with straight sections, with concealed bracing.
- D. Louvers, Windbourne Debris Zones: Provide 6-inch deep louvers, similar to above; certified, designed, and installed to meet the SSTD 12-99 wind load and missile impact criteria:
1. Louver shall be successfully tested for resistance to penetration by flying missiles per SSTD 12-99. Consider static/dynamic forces in louver design. See ASCE/SEI 7-10, wind velocity 170 mph, importance factor 1.0.
 2. Install louvers strictly in accordance with the manufacturer's instructions as required by the conditions of their test approval.
 3. Outside Air Intake Applications: Provide Ruskin Model ELF6375DXD/CD102 or approved equal installed with combination

control damper. Coordinate damper and damper actuator with Division 23 requirements.

E. LOUVER SCREENS

- A. General: Provide each exterior louver with louver screens complying with the following requirements:
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Bird screening, unless otherwise indicated.
- B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:
 - 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
 - a. Reinforce extruded-aluminum screen frames at corners with clips.
 - 2. Finish: Same finish as louver frames to which louver screens are attached.
 - 3. Type: Rewirable frames with a driven spline or insert for securing screen mesh.
- D. Louver Screening for Aluminum Louvers: Provide aluminum bird screening, 1/2-inch-square mesh, 0.063-inch wire.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish louvers after assembly.

- C. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
 - 1. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Aluminum Finish: Standard Clear Anodized Aluminum AA-M10C22A41 Architectural Class I (.7 mils minimum) All anodic finishes shall meet the requirements of the Aluminum Association DAF-45 and AAMA 611 for anodized architectural aluminum.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate Setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION

- A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect galvanized and nonferrous-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.

- G. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where weathertight louver joints are required. Comply with Division 7, Section 07 92 00 - JOINT SEALANTS for sealants applied during louver installation.

3.3 ADJUSTING, CLEANING, AND PROTECTING

- A. Periodically clean exposed surfaces of louvers and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Protect louvers and vents from damage during construction. Use temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at the time of Substantial Completion.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 90 00

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SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.1 INTENT

- A. The intent of this Specifications is to provide the material and workmanship necessary to produce complete protection of the surfaces to be coated for Lee County Utilities. This includes all surface preparation, pre-treatment, coating application, touch-up of factory coated surfaces, protection of surfaces not to be coated, clean-up, and appurtenant work, all in accordance with the requirements of the Contract Documents. Throughout this specification "ENGINEER" refers to the Lee County Utilities Project Manager or Contract Manager. And "OWNER" refers to Lee County Utilities.

1.2 PURPOSE

- A. The purpose of this Specification is to generally outline the work contemplated for the painting and protective coating work performed for Lee County Utilities, including Contract Operations, Capital Improvement Projects, and Developer Contributed Assets as defined under Scope below; together with the General Conditions, Special Provisions and all other Technical Specifications included herewith. All paints and materials used on interior tank or treatment unit surfaces shall conform to AWWA and/or Florida Department of Environmental Protection (FDEP) regulations as they may apply to potable water or wastewater service. The manufacturer furnishing the coating material may be required to furnish certification to the ENGINEER/OWNER that the materials meet these provisions.

1.3 DESCRIPTION

- A. The extent of painting work is shown on the project drawings, contracts and schedules, and as specified herein.
- B. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as otherwise specified or shown on the drawings.
 - 1. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of the work.
- C. The work includes field painting of exposed bare and covered pipes and ducts including color coding, and of hangers, exposed steel and iron work, tanks,

vessels, and primed metal surfaces of equipment installed under the mechanical and electrical work, except as otherwise indicated.

- D. Paint all exposed surfaces normally painted in the execution of a building project whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, or are not specifically excluded from the painting work, paint these the same as adjacent similar materials or areas. If color or finish is not designated, the OWNER will select these from standard colors available for the materials systems specified.

1.4 PAINTING NOT INCLUDED

- A. The following categories of work are not included as part of the field-applied finish work, unless otherwise noted on the drawings or in the Contract Documents.
 - 1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal, metal fabrications, hollow metal work, and similar items. Also, for fabricated components such as shop-fabricated or factory-built mechanical and electrical equipment or accessories.
 - 2. Pre-Finished Items: Unless otherwise shown or specified, do not include painting when factory-finishing or installer finishing is specified for such items as, but not limited to, finished electrical equipment including light fixtures, switchgear and distribution cabinets.
 - 3. Concealed Surfaces: Unless otherwise shown or specified, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas. Painting of galvanized work that will be concealed in the completed work is not required. Do not paint structural steel to be encased in concrete, nor structural steel specified not to be painted under Division 5. Except for touch-up as specified in Part 3, painting of shop primed structural steel and ferrous metals that will be concealed in the completed work is not required.
 - 4. Finished Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plating, copper, bronze and similar finished materials will not require finish painting, unless otherwise specified.
 - 5. Operating and Machined Parts and Labels: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, machined surfaces, grease fittings, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting unless otherwise specified.

- a. Do not paint over any code-requiring labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
- 6. Other Surfaces: Do not apply to glass, manhole frames and covers, aluminum platform gratings, stair treads, door thresholds, concrete wearing surfaces, or other walking surfaces unless otherwise specified.

1.5 CODES, STANDARDS AND REGULATIONS

- A. The work herein specified shall be performed in a legally acceptable manner, and it shall be the responsibility of the CONTRACTOR to obtain any and all licenses, permits, and legal approvals required to perform the work specified.
- B. All material and work covered by this specification shall comply with all currently approved or accepted provisions of applicable codes and standards published by the following organizations:

ANSI	-	American National Standards Institute 11 West 42nd New York, NY 10036 212-642-4900
API	-	American Petroleum Institute 1220 L Street N.W. Washington, DC 20005 202-682-8000
ASTM	-	American Society for Testing and Materials 100 Barr Harbor Dr. West Conshohocken, PA. 19428 610-832-9500
AWS	-	American Welding Society 550 N.W. LeJeune Rd. Miami, FL 33126 305-443-9353
AWWA	-	American Water Works Association 6666 West Quincy Avenue Denver, CO. 80235 303-794-7711

- FM - Factory Mutual Research
 1151 Boston-Providence Turnpike
 Norwood, MA 02062
 617-762-4300
- NACE - National Association of Corrosion Engineers
 PO Box 218340
 Houston, TX 77218
 1440 South Creek Dr.
 Houston, TX. 77084-4906
 713-492-0535
- NEMA - National Electrical Manufacturer's Association
 2101 L Street N.W. Ste. 300
 Washington DC 20037
 202-457-8400
- NFPA - National Fire Protection Association
 1 Batterymarch Park
 Quincy, MA 02269-9101
 617-770-3000
- OSHA - Occupational Safety and Health Act
 U.S. Department of Labor
 Occupational Safety & Health Administration
 8040 Peters Rd. Bldg. H-100
 Fort Lauderdale, FL 33324
 954-424-0242
- SAE - Society of Automotive Engineers
 400 Commonwealth Dr.
 Warrendale PA. 15096-0001
 412-776-4841
- SSPC - Steel Structures Painting Council
 40 24th Street
 Pittsburgh, PA 15222
 412-281-2331
- SSPWC - Standard Specifications for Public Works Construction
 Building News, Inc.
 3055 Overland Avenue
 Los Angeles, CA 90034
 310-202-7775

- UBC - Uniform Building Code
Published by ICBO
- UL - Underwriters Laboratories Inc.
333Psingsten Rd.
Northbrook IL. 67062
312-273-4255

C. The CONTRACTOR shall comply with all applicable Federal, state, and local laws and ordinances.

1.6 ACCEPTABLE COATING MANUFACTURERS

A. Material manufacturers approved by the Engineer are acceptable provided that they are established to the satisfaction of the ENGINEER as being compatible with and of equal quality to the coatings of the company listed. The CONTRACTOR shall provide satisfactory documentation from the firm manufacturing the proposed material that the material meets the specified requirements and is equivalent or better than the listed materials in the following properties:

1. Quality
2. Durability
3. Resistance to abrasion and physical damage
4. Life expectancy
5. Ability to recoat in future
6. Solids content by volume
7. Dry film thickness per coat
8. Compatibility with other coatings
9. Suitability for the intended service
10. Resistance to chemical attack
11. Temperature limitations in service and during application
12. Type and quality of recommended undercoats and topcoats
13. Ease of application

14. Ease of repairing damaged areas
 15. Stability of colors
- B. The cost of all testing and analyzing of the proposed substitute materials that may be required by the ENGINEER, shall be paid by the CONTRACTOR. If the proposed substitution requires changes in the contract work, the CONTRACTOR shall bear all such costs involved and the costs of allied trades affected by the substitution. These substitutions for other manufacturers must be made and approved prior to the bid date opening.

1.7 SUBMITTALS

- A. Coating Materials List: The CONTRACTOR shall provide six (6) copies of a coating materials list which indicates the manufacturer and the coating number, keyed to the coating schedule herein, for approval of the ENGINEER. The submittals shall be made sufficiently in advance of the coating operations to allow ample time for checking, correcting, resubmitting and rechecking.
- B. Paint Manufacturer's Information: For each paint system to be used, the CONTRACTOR shall submit the following listed data prior to beginning painting operations.
1. Paint manufacturer's data sheet for each product used.
 2. Technical and performance information that demonstrates compliance with the system performance and material requirements.
 3. Paint manufacturer's instructions and recommendations on surface preparation and application.
 4. Colors available for each product (where applicable).
 5. Compatibility of shop and field applied coatings (where applicable).
 6. Material safety data sheet for each product used.
- C. Samples and Manufacturer's Certificate: Provide all submittals, including the following, as specified in Division 1.
1. Submit manufacturer's standard color chart for color selection.
 2. Submit specimens, approximately 8 by 10 inches in size, for custom mixed colors for approval, not including color coding colors.

3. Where equipment is customarily shipped with a standard finish, submit samples of the proposed color and finish for approval prior to shipping.
4. Furnish affidavits from the manufacturer certifying that materials furnished conform to the requirements specified and that paint products have been checked for compatibility.
5. Submit a supplementary schedule of paint products with mil thickness, and solids by volume, including all paint applied in the shop and in the field. Provide a schedule that is in accordance with the recommendations of the paint manufacturer.
6. Furnish affidavits from the manufacturer certifying that coatings in immersion service contain no water-soluble solvents or corrosion inhibitive (active) pigments with slight water solubility.

1.8 DELIVERY AND STORAGE

- A. Deliver all coating materials to the job site in original, new and unbroken, sealed packages and containers bearing manufacturer's name and label, and the following information, all of which shall be plainly legible at the time of use:
 1. Name or title of material.
 2. Fed. Spec. number, if applicable.
 3. Manufacturer's stock number and date of manufacturer.
 4. Manufacturer's formula or specification number.
 5. Manufacturer's batch number.
 6. Manufacturer's name.
 7. Contents by volume, for major pigment and vehicle constituents.
 8. Thinning instructions.
 9. Application instructions.
 10. Color name and number.
 11. Expiration date.
- B. Store paint materials and painting tools and equipment, including solvents and cleaning materials, in a well ventilated, dry area and away from high heat. Do

not store in building or structure being painted, nor leave overnight therein. Follow manufacturer's recommendations for the safe storage of paints and solvents. CONTRACTOR shall store materials in compliance with all local, state, and federal regulations.

1.9 QUALITY ASSURANCE

- A. Inspection by the ENGINEER, or the waiver of inspection of any particular portion of the work, shall not relieve the CONTRACTOR of his responsibility to perform the work in accordance with these Specifications.
- B. Inspection Devices: The CONTRACTOR shall furnish, until final acceptance of the work, inspection devices in good working condition for the detection of holidays, measurement of surface profile, and measurement of dry film thicknesses of the protective coatings. Surface preparation comparison visual standards, profile and dry film thickness devices shall be made available for the ENGINEER's use at all times while coating is being done. The CONTRACTOR shall provide the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the ENGINEER.
- C. Surface Cleanliness: Preparation of metallic surfaces shall be based upon comparison with SSPC-VIS 1 (ASTM D2200), and as described herein. The CONTRACTOR shall furnish the photographic standards. To facilitate inspection, the CONTRACTOR shall, on the first day of abrasive blasting operations, abrasive blast metal panels to the standards specified. Plates shall measure a minimum of 8.5 inches by 11 inches. Panels meeting the requirements of the Specifications shall be initialed by the CONTRACTOR and the OWNER's representative and coated with a clear non-yellowing finish. One of these panels shall be prepared for each type of abrasive blasting and shall be used as a comparison standard throughout the project. The CONTRACTOR shall provide SSPC-VIS 1 Surface Preparation Standards for use during the abrasive blasting operations.
- D. Surface Profile: The blast abrasive shall be suitable to achieve the blast profile as required for the coating system used. The CONTRACTOR shall furnish for the ENGINEER's use, a Keane-Tator Surface Comparator No. 372 or approved equal.
- E. Film Thickness Testing: On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" (SSPC-PA2), using a magnetic-type dry film thickness gauge such as Mikrotest Model FM, Elcometer Model 111/1EZ, Positector 2000 or approved equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least eight (8) hours after application of the coating. On

non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.

- F. Holiday Testing: The CONTRACTOR shall holiday test all coated ferrous surfaces inside a steel reservoir, or other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested.
1. Coatings With Thickness Exceeding 20 Mils: For surfaces having a total dry film coating thickness exceeding 20 mils: Pulse-type holiday detector such as Tinker & Razor Model AP-W, D.E. Stearns Co. Model 14/20, or approved equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.
 2. Coatings With Thickness of 20 Mils or Less: For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Razor Model M-1 non-destructive type holiday detector, K-D Bird Dog or approved equal shall be used. The unit shall operate at less than 75-volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as Kodak Photo-Flo, or equal shall be added to the water prior to wetting the detector sponge.

1.10 MANUFACTURER'S REPRESENTATIVE

- A. The CONTRACTOR shall require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support and as may be necessary to resolve field problems attributable or associated with the manufacturer's products furnished under this contract or the application thereof.

1.11 SAFETY AND HEALTH REQUIREMENTS

- A. General: The CONTRACTOR shall provide and require use of personal protective and safety equipment for persons working in or about the project site, in accordance with requirements of OSHA Safety and Health Standards for Construction (29CFR 1910, 1915, and 1926) its revisions, and all other applicable regulations. The CONTRACTOR shall also comply with the coating manufacturer's printed instructions, appropriate technical bulletins, manuals, and material safety data sheets in the handling of potentially hazardous or harmful materials.
- B. Head and Face Protection and Respiratory Devices: The CONTRACTOR shall require all persons to wear protective helmets while in the vicinity of the work. In

additions, workers engaged in or near the work during sandblasting shall wear eye and face protection devices and air purifying, half-mask or mouthpiece respirators with appropriate filters. Barrier creams shall be used on any exposed areas of skin.

- C. Ventilation: Where ventilation is used to control hazardous exposure, all equipment shall be explosion proof. Forced air ventilation shall be provided to reduce the concentration of air contaminants to the degree such that a hazard does not exist and to assist in the proper curing of coatings applied in a confined area. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.
- D. Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels permitted under OSHA regulations, the CONTRACTOR shall provide and require the use of approved hearing protection devices.
- E. Illumination: Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the ENGINEER, the CONTRACTOR shall provide additional illumination to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the ENGINEER.
- F. Temporary Access: All temporary ladders and scaffolding shall conform to applicable safety requirements. Scaffolding shall be erected where requested by the ENGINEER to facilitate inspection and shall be moved by the CONTRACTOR to locations as requested by the ENGINEER.
- G. Cloths and cotton waste that might constitute a fire hazard shall be placed in fire resistant closed metal containers until removed from the project site or destroyed at the end of each workday.

1.12 WARRANTY

- A. All work covered under the Contract shall be guaranteed against defective workmanship and materials for a period of one (1) year after completion and acceptance of the work. A first anniversary inspection will be scheduled by the CONTRACTOR during the eleventh (11th) month following acceptance of the work. A report shall be furnished to the OWNER describing the condition of the paint system and other work covered under the Contract. Tank draining shall be coordinated with the OWNER. Any latent defects found during this inspection shall be promptly repaired by the CONTRACTOR at no additional cost to the OWNER. Any location where coats of paint have peeled off, bubbled or cracked, and any location where rusting is evident, shall be considered a failure of the paint system. The CONTRACTOR shall make repairs at all points where failures are observed by removing the deteriorated coating, cleaning the surfaces and recoating with the same paint system. Any such repair work shall be completed

by the CONTRACTOR within thirty (30) days after written notice of such defects unless otherwise negotiated.

- B. Failure on the part of the CONTRACTOR to schedule this warranty inspection will not relieve him of warranty responsibility and any defects found by the OWNER after the normal warranty period will be assumed to have occurred during the one (1) year while the warranty was in effect.

PART 2 PRODUCTS AND COATING SYSTEMS

2.1 GENERAL

- A. Definitions: The term "paint", "coatings", or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pre-treatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.
- B. Suitability: The CONTRACTOR shall use suitable coating materials as recommended by the manufacturer. Materials shall comply with Volatile Organic Compound (VOC) limits applicable at the Site.
- C. Material Sources: Where manufacturers and product numbers are listed, it is to show the type and quality of coatings that are required. If a named product does not comply with VOC limits in effect at the time of Bid opening, that product will not be accepted, and the CONTRACTOR shall propose a substitution product of equal quality that does comply. Proposed substitute materials will be considered as indicated below. Coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, and water and wastewater treatment plants.
- D. Compatibility: In any coating system, only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of the ENGINEER, a barrier coat shall be applied between all existing prime coats and subsequent field coats to insure compatibility.
- E. Containers: Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, and name of manufacturer, all of which shall be plainly legible at the time of use.
- F. Substitute or "Or-Equal" Products

1. To establish equality under Section 01 57 00 – Materials and Equipment, the CONTRACTOR shall furnish satisfactory documentation from the manufacturer of the proposed substitute or "or-equal" product that the material meets the indicated requirements and is equivalent or better in the following properties:
 - a. Minimum and maximum recoat times
 - b. Minimum and maximum cure time for immersion
 - c. Abrasion resistance per ASTM D4060 using CS17 Wheel
 - d. Maximum and minimum dry film thickness per coat
 - e. Compatibility with other coatings
 - f. Suitability for the intended service
 - g. Resistance to chemical attack
 - h. Temperature limitations during application and in service
 - i. Type and quality of recommended undercoats and topcoats
 - j. Ease of application
 - k. Ease of repairing damaged areas
 - l. Stability of colors
2. Protective coating materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. When requested, the CONTRACTOR shall provide the ENGINEER with the names of not less than 10 successful applications of the proposed manufacturer's products that comply with these requirements.
3. If a proposed substitution requires changes in the WORK, the CONTRACTOR shall bear such costs involved as part of the WORK.

2.2 COLORS AND FINISHES

- A. All colors and shades of colors for all coats of paint shall be as selected or specified. Paint colors, surface treatment, gloss, and finishes, are indicated or specified in the "schedules" of the contract documents. Color and gloss not indicated or specified will be selected by the OWNER.
- B. Each coat shall be of a slightly different shade, as directed by the ENGINEER, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples or shall be customer mixed to match color samples furnished by the ENGINEER. Final acceptance of colors will be from samples applied on the job.
- C. Color Pigments: Pure, non-fading, applicable types to suit the substrates and service indicated.

- D. Paint Coordination: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Furnish information to manufacturers, fabricators, suppliers and others where necessary on the characteristics of the finish materials to be used, to ensure compatible prime coats of use. Provide barrier coats over incompatible primers or remove and re-prime as required.
- E. Color Coding: All exposed piping in structures, aboveground or in pipe trenches, shall be color code painted in strict accordance with the color code chart presented in Paragraph 3-15 of this section. All colors shall be as specified or as selected by the OWNER.

2.3 UNDERCOATS AND THINNERS

- A. Undercoats: Provide undercoat paint produced by the same manufacturer as the finish coats.
- B. Thinners: Use only thinners approved by the paint manufacturer and use only within recommended limits.

2.4 INDUSTRIAL COATING SYSTEMS

- A. The CONTRACTOR shall use coating materials suitable for the intended use and recommended by their manufacturer for the intended service.
- B. Protective Coating Materials: Products shall be standard coatings produced by recognized manufacturers regularly engaged in production of such materials for application on essentially identical facilities to those proposed in this project. Where requested, the CONTRACTOR shall provide the ENGINEER with the names of not less than ten (10) successful applications of the proposed manufacturer's products, which have been proven over a three (3) year period of time, demonstrating compliance with this specification requirement.

C. System 1 - Alkyd Enamel

1. Materials

Primer	Manufacturer's recommendation
Finish Coat	1 component alkyd enamel
Type	high quality alkyd, medium long enamel
Demonstrated suitable for	ferrous and nonferrous surfaces in industrial exposure, producing high gloss surface that is resistant to mild corrosion and chemical fumes, has good color and gloss retention, good weathering, and sunlight resistance
VOC Content, max	420 grams per liter

2. Application and manufacturers

Prime Coat (DFT = 2 to 4 mils)	Finish Coat (DFT = 2 to 4 mils)	Total System DFT
PPG Amercoat 5105	Amercoat 5450	4 to 8 mils
Tnemec Series L69	Tnemec Series 2H	
Devoe Devprime 1401	Devoe Devlac 1431	
Carboline Carbocoat 150	Carbocoat 45	
Sherwin Williams Kem Bond HS	S-W Industrial Enamel HS	

D. System 2 - Aluminum Silicone

1. Material

Type	High heat silicone with aluminum
Demonstrated suitable for	Ferrous surfaces, continuous temperatures of 1000 deg F
VOC Content, max	637 grams per liter

2. Application and manufacturers

Total System DFT = 3 mils
Carboline Thermaline 4700 - Aluminum, 2 coats
International Intertherm 50, 2-3 coats
Sherwin William Hi-Temp Coatings 1000V, 2 coats.

E. System 2 (VOC-Limited) - Aluminum Silicone

1. Material

Type	High heat silicone containing aluminum
Demonstrated suitable for	Ferrous surfaces with continuous temperatures at 1000 deg F and peaks of 1200 deg F
VOC Content, max	420 grams per liter

2. Application and manufacturers

Total System DFT = 3 mils
PPG- Amercoat 872 followed by PPG- Amercoat 873
Carboline Thermaline 4700 VOC Aluminum, 2 coats.
Sherwin Williams Hi-Temp Coatings 1000V, 2 coats.
International Intertherm 1202 UPC (1 coat – 4 mils)

F. System 3 - Epoxy/Polyurethane

1. Materials

Primer type	rust-inhibitive, 2 component epoxy
VOC Content, max	285 g/L
Finish type	2 component aliphatic polyurethane
VOC Content, max	300 g/L
Demonstrated suitable for	ferrous surfaces, superior color and gloss retention, exceptional resistance to weathering, chemical fumes, and splash

2. Application and manufacturers

Prime Coat (DFT = 3 - 5 mils)	Finish Coat (DFT = 3 - 4 mils)	TOTAL SYSTEM DFT
PPG- Amerlock 400/2	PPG- Amershield	6 - 9 MILS
Carboline Carboguard 893	Carboline Carbothane 134 HG (2 coats)	
Devoe Devran 224V	Devoe Dethane 379H	
Tnemec Hi-Build Epoxoline II Series L69	TNEMEC SERIES 750UVX	
Sherwin Williams Macropoxy 646	Sherwin Williams Hi-Solids Polyurethane	

G. System 3 (VOC-Limited) - Epoxy/Polyurethane

1. Materials

Primer type	rust-inhibitive, 2 component epoxy
VOC Content, max	250 g/L
Finish type	2 component aliphatic polyurethane
VOC Content	250 g/L, max
Demonstrated suitable for	Superior color and gloss retention, resistance to weathering, chemical fumes and splash

2. Application and manufacturers

Prime Coat (DFT = 3 - 5 mils)	Finish Coat (DFT = 3 -4 mils)	TOTAL SYSTEM DFT
Carboline 893	Carboline 134 VOC	6 - 9 MILS
Devoe Devran 224V	Devoe 379H	
Tnemec Hi-Build Epoxoline II Series L69	Tnemec Series 750UVX	
PPG Amerlock 400/2	Amershield VOC	
Sherwin Williams Macropoxy 646	S W Hi-Solids Polyurethane 100	

H. System 4 - Inorganic Zinc/Epoxy/Polyurethane

1. Material

Prime Coat	Inorganic zinc silicate, water or solvent based, 2 component
zinc content in dry film	83 percent, minimum
VOC Content, max	325 grams per liter
Demonstrated suitable for	Ferrous metal, providing superior corrosion, chemical, and abrasion resistance, recommended for use as primer under epoxy
Intermediate Coat	2 component epoxy, high build, recommended by manufacturer for application over inorganic zinc primer
VOC Content, max	276 grams per liter
Demonstrated suitable for	Outstanding chemical, corrosion, and abrasion resistance
Finish Coat	2 component aliphatic or acrylic polyurethane
VOC Content, max	315 grams per liter
Demonstrated suitable for	Superior color and gloss retention, resistance to chemical fumes and severe weathering, abrasion resistance

2. Application and manufacturers

Surface preparation for primer	SSPC SP 6
Anchor profile for primer	per manufacturer

Prime Coat (DFT = 2 - 4 mils)	Intermediate Coat (DFT = 3 - 5 mils)	Finish Coat (DFT = 2 - 4 mils)	Total System DFT
PPG- Dimetcote 9HS or Dimetcote 21-5	Amercoat 385	Amercoat 450H	7 - 13 mils
Carboline Carbozinc 11HS or 11WB	Carboguard 890	Carbothane 134HG	
Devoe Cathacote 302H	Devran 224V	Devthane 379H	
Tnemec Tneme-Zinc 94H20	Tnemec Series L69	Tnemec Series 750 UVX	
Sherwin Williams Zinc Clad II Plus	S W Macropoxy 646	S W Hi-Solids Polyurethane	

I. System 4 (VOC-Limited) - Inorganic Zinc/Epoxy/Polyurethane

1. Materials

Prime Coat	Inorganic zinc silicate, water-based, 2 component
zinc content in dry film	79 percent, minimum
VOC content, max	0 grams per liter
Demonstrated suitable for	Ferrous metal, providing superior corrosion, chemical, and abrasion resistance, recommended for use as primer under epoxy
Intermediate Coat	2 component epoxy, high build, recommended by manufacturer for application over inorganic zinc primer
Demonstrated suitable for	Outstanding chemical, corrosion, and abrasion resistance
VOC content, max	250 grams per liter
Finish Coat	2 component aliphatic or acrylic polyurethane
Demonstrated suitable for	Superior color and gloss retention, resistance to chemical fumes, severe weathering, and abrasion
VOC content, max	250 grams per liter

2. Application and manufacturers

Surface preparation for primer	SSPC SP 10
Anchor profile for primer	per manufacturer

Prime Coat (DFT = 3 - 4 mils)	Intermediate Coat (DFT = 4 - 6 mils)	Finish Coat (DFT = 3 - 4 mils)	Total System DFT
PPG- Dimetcote 21-5	Amerlock 400/2	Amershield VOC	10 - 14 mils
Carboline Carbozinc 11WB	Carboguard 893	Carbothane 134VOC	
Tnemec Tneme-Zinc 94H20	Tnemec Series L69	Tnemec Series 750 UVX	
Sherwin Williams Zinc Clad XI	S W Macropoxy 646	S-W Hi-Solids Polyurethane 250	
Devoe Cathacote 305	Devoe Devran 224V	Devoe Devthane 379H	

J. System 5 - Inorganic Zinc, Water Based

1. Material

Type	water based zinc silicate, 2 component
Percent Zinc in dry film	83, min
VOC Content, max	0 grams per liter
Demonstrated suitable for	Severe weathering and moderate chemical fumes, continuous temperatures of 750 deg F

2. Application and manufacturers

Product (2 coats at 2 - 4 mils each)	Total System DFT
PPG- Dimetcote 21-5	4 - 8 mils
Devoe Cathacoat 305	
Carboline Carbozinc 11 WB	
Sherwin Williams Zinc Clad XI	

K. System 6 - Acrylic Latex

1. Material

Primer	Product, surface preparation, and DFT as recommended by manufacturer for the surface
Finish Type	Single component, water based acrylic latex, with fungicide
VOC Content, max	180 grams per gallon
Demonstrated suitable for	PVC piping, weather and mild chemical resistance, excellent color and gloss retention

2. Application and manufacturers

Finish (at least 2 coats required)	Total System DFT
PPG- Amercoat 220	primer plus 6 mils
Carboline Carbocrylic 3359	
Tnemec Series 1028 Enduratone	
Sherwin Williams Metalatex	
Devoe Devcryn 530	

L. System 7 - Epoxy, Equipment

1. Materials

Primer Type	2 component epoxy, recoatable up to one year
Demonstrated suitable for	Rust inhibitive, outstanding chemical, abrasion, and weathering resistance, resistance to splash, washdown, and condensation. Immersion capability is not required
VOC content, max	330
Finish Type	2 component epoxy, available in many colors
Demonstrated suitable for	Outstanding chemical, abrasion, and weathering resistance, resistance to splash, washdown, and condensation. Immersion capability is not required
VOC content, max	330

2. Application and manufacturers

Prime Coat (DFT = 4 to 6 mils)	FINISH COAT (DFT = 3 TO 4 MILS)	TOTAL SYSTEM DFT
PPG-Amerlock 400	Amerlock 400	7 to 10 mils
Tnemec Series L69	Tnemec Series L69	
Devoe Devran 224V	Devran 224V	
Carboline Carboguard 888	Carboguard 888	
Sherwin Williams Macropoxy 646	S W Macropoxy 646	

M. System 7 (VOC-Limited) - Epoxy, Equipment

1. Materials

Primer Type	2 component epoxy, recoatable up to one year
Demonstrated suitable for	Rust inhibitive, outstanding chemical, abrasion, and weathering resistance, resistance to splash, washdown, and condensation. Immersion capability is not required
VOC content, max	250
Finish Type	2 component epoxy, available in many colors
Demonstrated suitable for	Outstanding chemical, abrasion, and weathering resistance, resistance to splash, washdown, and condensation. Immersion capability is not required
VOC content, max	250

2. Application and manufacturers

Prime Coat (DFT = 4 - 5 mils)	Finish Coat (DFT = 4 - 5 MILS)	Total System DFT
Devoe Bar-Rust 231	Devoe 224V	8 - 10 mils
PPG- Amerlock 400/2	Amerlock 400/2	
Tnemec Series L69	Tnemec Series L69	
Carboguard 60	Carboguard 60	
Sherwin Williams Macropoxy 646	S W Macropoxy 646	

N. System 8 - Inorganic Zinc/Epoxy, Equipment

1. Materials

Primer type	Water or solvent-based inorganic, self-curing zinc silicate
Zinc content in dry film, min	84 percent
VOC content, g/L, max	323
Demonstrated suitable for	Superior corrosion, chemical and abrasion resistance, recommended as primer under epoxy
Finish type	2 component polyamide epoxy available in many colors
VOC content, g/L, max	250
Demonstrated suitable for	Good resistance to chemical attack, weathering, splash, washdown, and condensation

2. Application

Prime Coat (DFT = 3 to 4 mils)	Finish Coats (2 or more) (DFT = 4 to 8 mils each)	Total System DFT
PPG- Dimetcote 9 HS	Amerlock 400	11 to 20 mils
Carboline Carbozinc 11HS	Carboguard 890	
Tnemec Hydro-Zinc 94H2O	Tnemec Series L69	
Sherwin Williams Zinc Clad II Plus	S W Macropoxy 646	
Devoe Cathacote 302H	Devoe Devran 224V	
International Interzinc 22HS	International Interseal 670HS	

O. System 8 (VOC-Limited) - Inorganic Zinc/Epoxy, Equipment

1. Materials

Primer type	Water-based inorganic, self-curing zinc silicate
Zinc content in dry film	83 percent, min
Demonstrated suitable for	Superior corrosion, chemical and abrasion resistance, recommended as primer under epoxy
Finish type	2 component polyamide epoxy
VOC Content, max	215 g/L
Demonstrated suitable for	Good resistance to chemical attack, weathering, splash, washdown, and condensation, available in many colors

2. Application and manufacturers

Prime Coat (DFT = 3 to 5 mils)	Finish Coats (2 or more) (DFT = 4 to 6 mils each)	Total System DFT
Devoe Cathacote 305	Devran 224V	11 to 17 mils
Carboline Carbozinc 11WB	Carboguard 890	
PPG- Dimetcote 21-5	Amerlock 400/2	
Sherwin Williams Zinc Clad XI	S-W Macropoxy 646	

P. System 9 - Acrylic, Concrete

1. Materials

Filler-Sealer Type	Epoxy or acrylic masonry sealer, for concrete and CMU, for wet and dry conditions
Primer	as recommended by manufacturer
VOC Content, g/L, max	75
Finish Type	single component waterborne acrylic, industrial grade, high molecular weight
VOC Content, g/L, max	180
Demonstrated suitable for	concrete under mild to moderate exposure conditions, splash but not immersion

2. Application and manufacturers

Prime Coat (Filler-Sealer)	Finish Coat (DFT = 5 - 7 mils) (2 or more coats)	Total System DFT
Tnemec EnviroFill 130	Tneme-Crete 180 Series	5 - 7 mils plus primer
PPG- Amerlock 400BF and Amercoat 114A	Amercoat 220P	
Carboline Sanitile 500	Carbocrylic 3359DTM	
Sherwin Williams Cement Plex 875 (acrylic) and Kem Cati Coat (epoxy)	S W Metalatex	
Devoe Tru-Glaze 4015	Devoe Devcryn 1449	

Q. System 10 - Polyurethane, Fiber Glass

1. Materials

Primer Type	as recommended by manufacturer
Finish Type	2 component aliphatic polyurethane
Demonstrated suitable for	Fiberglass, superior color and gloss retention, resistance to acid and alkali splash, fumes, and severe weathering, no immersion
VOC content, g/L max	300

2. Application and manufacturers

Prime Coat (3 to 4 mils)	Finish Coats (4 to 6 mils)	Total System DFT
PPG- Amerlock 400	Amershield	7 to 10 mils
Tnemec Series 750 UVX	Tnemec Series 750 UVX	
Carboline Carbocrylic 120 (2 coats)	Carbothane 134 HG (2 coats)	
SHERWIN WILLIAMS MACROPOXY 646	S-W Hi-Solids Polyurethane	
DEVOE DEVRAN 224V	Devoe Devthane 379H	

R. System 10 (VOC-Limited) - Polyurethane, Fiber Glass

1. Materials

Primer Type	as recommended by manufacturer
Finish Type	2 component aliphatic polyurethane
Demonstrated suitable for	Fiberglass, superior color and gloss retention, resistance to acid and alkali splash, fumes, and severe weathering, no immersion
VOC content, max	250 g/L

2. Application

Prime Coat (3 to 4 mils)	Finish Coats (4 to 6 mils)	TOTAL SYSTEM DFT
Devoe Bar-Rust 231	DEVTHANE 379H (2 coats)	7 to 10 mils
Carboline Carbocrylic 120 (2 coats)	Carbothane 134 VOC (2 coats)	
PPG Amerlock 400	Amershield VOC	
Tnemec Epoxoline Series L69	Tnemec Series 750 UVX	
Sherwin Williams Macropoxy 646	S-W Hi-Solids Polyurethane 250	

2.5 SUBMERGED AND SEVERE SERVICE COATING SYSTEMS

A. System 100 - Amine Cured Epoxy

1. Material

Type	high build, amine cure epoxy
VOC content, g/L max	220
Demonstrated suitable for	steel, long-term immersion in water and wastewater, resistant to corrosion, chemical fumes, good color retention
Certification	NSF 61 if in contact with potable water

2. Application and manufacturers

Products (3 coats or more)	Total System DFT
<u>PPG- Amercoat 133</u>	15 to 17 mils For non-submerged valves and other equipment, DFT = 10 to 12 mils
Carboline Carboguard 891HS	
International Bar-Rust 233H	
Tnemec Epoxoline Series L69	
Sherwin Williams Macropoxy 646 PW	

B. System 101 - Polyamide Epoxy

1. Materials

Type	high build polyamide cure epoxy
VOC content, max, g/L	366
Demonstrated suitable for	long term immersion in water and wastewater, resistant to corrosion and chemical fumes, good color retention
Certification	NSF 61 if in contact with potable water

2. Application and manufacturers

Products (3 coats or more)	<u>Total System DFT</u>
<u>PPG- Amercoat 370</u>	11 - 13 mils
Tnemec Pota-Pox Series 20	
Carboline Carboguard 61	
Sherwin Williams Macropoxy 646 PW for water and Dura-Plate 235 for wastewater	
Devoe Bar-Rust 233H	

C. System 101 (VOC-Limited) - Polyamide Epoxy

1. Materials

Type	high build polyamide cure epoxy
VOC content, max, g/L	250
Demonstrated suitable for	long term immersion in water and wastewater, resistant to corrosion and chemical fumes, good color retention
Certification	NSF 61 if in contact with potable water

2. Application and manufacturers

Products (3 coats or more)	<u>Total System DFT</u>
<u>Devoe Bar-Rust 233H</u>	12 - 18 mils
Tnemec L140F	
PPG- Amerlock 400/2	
Carboguard 61	
Sherwin Williams Macropoxy 646 PW for water and Dura-Plate 235 for wastewater	

D. System 102 - Epoxy, Steel Reservoirs

1. Materials: In accordance with AWWA D102 - Coating Steel-Water Storage Tanks, System ICS-2.

Type	2 component epoxy, polyamide or amine-cure type
Demonstrated suitable for	Steel, long-term immersion in potable water
VOC content, g/L max	366
Certification required	NSF 61

2. Application and manufacturers

First Coat (2 - 4 mils)	Second Coat (3 - 5 mils)	Finish Coat (4 - 6 mils)	<i>Total System DFT</i>
PPG- Amerlock 2	Amerlock 2	Amerlock 2	9 - 15 mils
Carboline Carboguard 891	Carboguard 891	Carboguard 891	
Tnemec Pota- Pox L140F	Tnemec L140F	Tnemec L140F	
Sherwin Williams Macropoxy 646 PW	S-W Macropoxy 646 PW	S-W Macropoxy 646 PW	
Devoe Bar Rust 233H	Devoe Bar-Rust 233H	Devoe Bar-Rust 233H	

E. System 102 (VOC-Limited) - Epoxy, Steel Reservoirs

1. Materials: In accordance with AWWA D102 - Coating Steel-Water Storage Tanks, System ICS-2.

Type	2 component epoxy, polyamide or amine-cure
Demonstrated suitable for	long term immersion in potable water
VOC content, g/L max	250
Certification required	NSF 61

2. Application and manufacturers

First Coat (3 - 5 mils)	Second Coat (4 - 6 mils)	Finish Coat (5 - 7 mils)	Total System DFT
PPG- Amercoat 133	Amercoat 133	Amercoat 133	12 - 18 mils
Carboline Carboguard 891	Carboguard 891	Carboguard 891	
Tnemec Pota-Pox Plus L140F	Tnemec L140F	Tnemec L140F	
Sherwin Williams Macropoxy 646 PW	S-W Macropoxy 646 PW	S-W Macropoxy 646 PW	
Devoe Bar Rust 233H	Devoe Bar-Rust 233H	Devoe Bar-Rust 233H	

3. All lap roof plate edges, both sides, shall be pre-coated. If necessary, primer exposed on exterior of roof may be removed prior to welding. Pre-coating shall extend at least 6-inches from plate edges.
4. Touch-up coating shall be done for areas damaged during erection, or areas not pre-coated. The CONTRACTOR shall spot sandblast to SSPC SP-5 - White Metal Blast Cleaning, before application of coating. Material used for touch-up shall be the indicated material or a compatible primer recommended by the manufacturer.
5. All edges, nuts, bolts, lap joints, weld seams, and the roof rim angle shall receive one brush-applied coat prior to the application of the first complete spray coat.
6. Curing Period: Prior to immersion, the completed system shall be subjected to at least 240 hours of curing time with the metal temperature at a minimum of 70 degrees F, or 480 hours at a minimum of 60 degrees F, both conditions at a maximum relative humidity of 50 percent and under the forced ventilation conditions required by the paragraph entitled Curing of Coatings. More curing time or a higher temperature shall be provided if recommended by the epoxy coating manufacturer. If the environmental conditions do not provide the necessary minimum temperature, use heated air to provide the necessary heat for curing. Other combinations of curing time and temperature may be used if the coating manufacturer presents satisfactory documentation and test results to substantiate that the degree of curing is equal or greater than curing for 240 hours at 70 degrees F.

F. System 103 - Fusion Bonded Epoxy

1. Material

Type	100 percent solids fusion bond epoxy
Demonstrated suitable for	fluidized bed or electrostatic spray application, recommended for pumps, valves, pipe appurtenances, tanks, pipe hangers, flow meters, and hydrants
Certification requirement	NSF 61

2. Application in accordance with AWWA C213 and the following:

Product	Surface and DFT
3M Scotchkote 134 or 206N	Valves 12-mils
	All others 16-mils

G. System 104 - Polyurethane, Concrete

1. Materials

Filler-sealer type	epoxy material with portland cement and aggregate
Primer type	Phenolicamine or polyamidoamine epoxy
VOC content, g/L max	250
Finish type	aromatic elastomeric polyurethane
Demonstrated suitable for	concrete and concrete block masonry, long term immersion in water and wastewater and service where subject to splash and spill of water and wastewater treatment chemicals
VOC content, g/L max	250
Certification requirement, where coating will be in contact with potable water	NSF 61

2. Application and manufacturers

Filler-Sealer	Primer DFT = 3 - 7-mils	Finish Coat DFT = 100 - 125-mils, 75 mils for potable water
Tnemec MortarClad 218	Tnemec Pota-Pox L140 (potable water) Epoxoprime 201 (wastewater)	Elasto-Shield 406 (max 75 mils for potable water)
PPG-Amerlock 400/BF	Amerlock 400/2	Amerlock 490
Sherwin Williams Steel Seam FT 910	S-W Dura-Plate 235	S-W Sherflex (Max 100 mils for potable water)
International Ceilcote 400 Corocrete	Polibrid 670-S	Polybrid 705

H. System 105 - Epoxy, Concrete

1. Materials

Filler-sealer type	Epoxy material with portland cement and aggregate
Primer type	100% solids epoxy
VOC content, g/L max	100
Finish type	Amine cure epoxy/aggregate-filled epoxy
Demonstrated suitable for	Sewer manhole & wastewater facility, long term immersion in wastewater service where subject to chemical and bacteriological attack found in municipal sanitary sewer system
VOC content, g/L max	100

2. Application and manufacturers

Filler-Sealer	Primer DFT = 5 – 10 mils	Finish Coat DFT = 125 – 150 mils
RLS Raven 210	RLS Raven 155	Raven 405 FS
Sauereisen Filler Compound 209 or 209FS	Per Sauereisen	SewerGard 210
		Warren Environmental

2.6 SPECIAL COATING SYSTEMS

A. System 200 - Acrylic, Wood and Gypsum Board

1. Materials

Primer type	as recommended by manufacturer
Finish type	single component, water based, acrylic, fungicide added
VOC content, max, g/L	250
Demonstrated suitable for	wood, mild to moderate exposure inside and outside building, and gypsum board, inside

2. Application and manufacturers

Prime Coat (1.5 to 2.5 mils)	Finish Coat (4 to 6 mils) (2 coats)	Total System DFT
PPG- Amercoat 220P	Amercoat 220P	5.5 to 8.5 mils
Carbocrylic 120	Carbocrylic 3359	
Tnemec Series 115 Unibond	Tnemec Series 1028 Enduratone	
Sherwin Williams PrepRite ProBlock	S-W Metalatex	
Devoe Devcryn 520	Devoe Devcryn 1449	

PART 3 EXECUTION

3.1 MANUFACTURER'S SERVICES

- A. The CONTRACTOR shall require the protective coating manufacturer to furnish a qualified technical representative to visit the Site for technical support as may be necessary to resolve field problems.
- B. For submerged and severe service coating systems, the CONTRACTOR shall require the paint manufacturer to furnish the following services:
 - 1. The manufacturer's representative shall provide at least 6 hours of on-Site instruction in the proper surface preparation, use, mixing, application, and curing of the coating systems.
 - 2. The manufacturer's representative shall observe the start of surface preparation, mixing, and application of the coating materials for each coating system.

3.2 WORKMANSHIP

- A. Skilled craftsmen and experienced supervision shall be used on coating WORK.
- B. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough surface preparation. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given so that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.
- C. Damage to other surfaces resulting from the WORK shall be cleaned, repaired, and refinished to original condition.

3.3 STORAGE, MIXING AND THINNING OF MATERIALS

- A. Manufacturer's Recommendations: Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed. No substitutes or other deviations will be permitted without written permission of the ENGINEER. The CONTRACTOR shall supply the ENGINEER with copies of each manufacturer's instructions in accordance with the requirements of Paragraph 1-07, "SUBMITTALS".

- B. All protective coating materials shall be used within the manufacturer's recommended shelf life.
- C. Storage and mixing of paint or other coating materials shall be performed only in those areas designated by the ENGINEER.

3.4 PREPARATION FOR COATING

- A. General: All surfaces to receive protective coatings shall be cleaned as specified herein prior to application of said coatings. The CONTRACTOR shall examine all surfaces to be coated and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application. Do not paint over dirt, rust, scale, oil, grease, moisture, scuffed surfaces or other foreign material or in conditions otherwise detrimental to the formation of a durable paint bond and film.
- B. Protection of Surfaces Not to be Coated: Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations. All hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.
- C. Protection of Adjacent Work and Areas: Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The CONTRACTOR shall be fully responsible for and shall promptly repair to the satisfaction of the OWNER any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.
- D. Protection of Painted Surfaces: Cleaning and coating shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly-coated surfaces.

3.5 ENVIRONMENTAL REQUIREMENTS

- A. No coating work shall be performed under the following conditions:
 - 1. Surface or ambient temperatures exceed the manufacturer's recommended maximum or minimum allowable.
 - 2. Dust or smoke laden atmosphere.

3. Damp or humid conditions, where the relative humidity is above the manufacturer's maximum allowable.
4. Substrate and ambient temperatures are less than 5°F above the dew point and are decreasing. Dew point shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce, Weather Bureau psychrometric tables. Elcometer 319 Dew Point meter or equal may also be used.
5. Ambient temperature that is expected to drop below 50°F or less than 5°F above the dew point within 8 hours after application of coating.

3.6 SURFACE PREPARATION STANDARDS

- A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this Specification:
 1. Solvent Cleaning (SSPC-SP1): The method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces through the use of solvent, vapor, emulsion, alkaline, and/or steam.
 2. Hand Tool Cleaning (SSPC-SP2): The method for removing all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter through the use of non-power hand tools.
 3. Power Tool Cleaning (SSPC-SP3): The method for removing all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter through the use of power assisted hand tools.
 4. White Metal Blast Cleaning (SSPC-SP5): The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, and paint.
 5. Commercial Blast Cleaning (SSPC-SP6): The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, and paint. Evenly dispersed very light shadows, streaks, and discolorations caused by stains of rust, mill scale, and previously applied paint may remain on no more than 33% of the surface.
 6. Brush-off Blast Cleaning (SSPC-SP7): The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface.

7. Near-White Blast Cleaning (SSPC-SP10): The method of preparing steel surfaces which, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, and paint. Evenly dispersed very light shadows, streaks, and discolorations caused by stains of rust, mill scale, and previously applied paint may remain on no more than 5% of the surface.

3.7 SURFACE PREPARATION

- A. General: Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
 1. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
 2. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly painted surfaces. Remove mildew in accordance with the paint manufacturer's recommendations.

3.8 NEW FERROUS METAL SURFACE PREPARATION (UNGALVANIZED)

- A. The minimum abrasive blasting surface preparation shall be as specified in the coating system schedules included at the end of this section. Where there is a conflict between these Specifications and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.
- B. Workmanship for metal surface preparation shall be in conformance with the current SSPC Standards and this section. Blast cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers (NACE) Standard TM-01-70.
- C. All oil, grease, welding fluxes and other surface contaminants shall be removed by alkaline cleaning per SSPC-SP1 prior to blast cleaning.
- D. All sharp edges shall be rounded or chamfered and all burrs, surface defects and weld splatter shall be ground smooth prior to blast cleaning.

- E. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions. CONTRACTOR shall submit data and samples for approval on abrasives to be used on the Project. Abrasives that are used shall be designed for the specific purpose of blast cleaning. Abrasives shall be free of contaminants and chlorides. Ordinary builder's sand shall not be considered to be approved abrasive material. ENGINEER will periodically sample abrasives used at the job site for comparison with approved submitted materials.
- F. The abrasive shall not be reused unless otherwise approved by the ENGINEER. For automated shop blasting systems, clean oil and moisture-free abrasives shall be maintained.
- G. The CONTRACTOR shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.
- H. Compressed air for air blast cleaning shall be supplied at adequate pressure from well-maintained compressors equipped with oil/moisture separators which remove all contaminants.
- I. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming or other approved method prior to painting.
- J. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.
- K. Damaged or defective coating shall be removed by the specified blast cleaning to meet the clean surface requirements before recoating.
- L. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, the SSPC-SP2, Hand Tool Cleaning, or SSPC-SP3, Power Tool Cleaning, will be permitted.
- M. Shop applied coatings of unknown composition shall be completely removed before the specified coatings are applied. Valves, castings, ductile iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by Solvent Cleaning per SSPC-SP1 before the abrasive blast cleaning work has been started.
- N. Shop primed equipment shall be alkaline cleaned in the field before finish coats are applied.

3.9 FERROUS METAL SURFACE PREPARATION (GALVANIZED)

- A. All installation and erection caused blemishes to galvanized surfaces shall be touched up in accordance with ASTM A780 prior to coating.
- B. Galvanized ferrous metal shall be alkaline cleaned per SSPC-SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system to be used.
- C. Pretreatment coatings of surfaces shall be in accordance with the printed recommendations of the coating manufacturer. Galvanized metals may be cleaned with suitable organic solvent such as a rust inhibitor or aqueous alkaline solution per ASTM D6386.

3.10 SURFACE PREPARATION OF FERROUS SURFACES WITH EXISTING COATINGS, EXCLUDING STEEL TANK OR TREATMENT UNIT INTERIORS (IN ADDITION TO REQUIREMENTS IN PARAGRAPHS 3-05 AND 3-06).

- A. General: All grease, oil, heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The CONTRACTOR shall determine the generic type of the existing coatings by laboratory testing, at no additional cost to the OWNER.
- B. Abrasive Blast Cleaning: The CONTRACTOR shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not specified in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6, Commercial Blast Cleaning. Areas of tightly adhering coatings shall be cleaned to SSPC-SP7, Brush-Off Blast Cleaning, with the remaining thickness of existing coating not to exceed 3 mils.
- C. Incompatible Coatings: If coatings to be applied are not compatible with existing coatings, the CONTRACTOR shall apply intermediate coatings per the paint manufacturer's recommendation for the specified abrasive blast cleaning. A small trial application shall be conducted for compatibility prior to painting large areas.
- D. Unknown Coatings: Coatings of unknown composition shall be completely removed prior to application of new coatings.

3.11 SURFACE PREPARATION FOR REPAINTING EXISTING STEEL

- A. The entire structure is to be completely pressure washed at 3,000 to 5,000 psi with potable water.

- B. All areas shall be cleaned/sandblasted to the surface preparation standards as specified herein or superseded by the bid form.
- C. All cleaned areas are to be primed the same workday that they are cleaned and blasted.

3.12 PRESSURE WASH CLEANING FOR REPAINTING EXISTING CONCRETE

- A. The entire structure is to be pressure washed at 3,000 to 5,000 psi with a solution of 50% water and bleach to yield a mixture with a minimum concentration of 2-1/2% sodium hypochlorite.
- B. The entire structure is to be completely rinsed by pressure washing at 3,000 to 5,000 psi with potable water.

3.13 CONCRETE AND CONCRETE BLOCK MASONRY SURFACE PREPARATION

- A. Surface preparation shall not begin until at least 30 days after the concrete has been placed.
- B. All efflorescence, chalk, dust, dirt, oil and grease shall be removed by Detergent Cleaning per SSPC-SP1 before abrasive blast cleaning.
- C. Concrete, concrete block masonry surfaces, previously painted concrete and masonry and deteriorated concrete and masonry surfaces to be coated shall be abrasive blast cleaned to remove laitance, paint, deteriorated concrete, and roughen the entire surface equivalent to the surface of the No. 80 grit flint sandpaper. Concrete shall have a consistent, even texture (void free) and shall be patched where needed.
- D. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Do not paint over surfaces where the moisture content exceeds that permitted in the manufacturer's printed directions.
- E. If acid etching is required by the coating application instructions, the treatment shall be made after sandblasting. After acid etching, rinse surfaces with clean water to neutralize the acid and test the pH. The pH shall be between 7.0 and 8.0.
- F. Surfaces shall be clean and dry and as recommended by the coating manufacturer before coating is started.

- G. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhors Model DB or approved equal.
- 3.14 PLASTIC, FIBERGLASS AND NONFERROUS METALS SURFACE PREPARATION
- A. Plastic and Fiberglass surfaces shall be sanded or Brush Off Blast Cleaned, SSPC-SP7, prior to solvent cleaning with a chemical compatible with the coating system primer. If blast cleaned, use 60-80 mesh abrasive.
 - B. Non-ferrous metal surfaces shall be Solvent Cleaned, SSPC-SP1, followed by sanding or Brush Off Blast Cleaning, SSPC-SP7.
 - C. All surfaces shall be clean and dry prior to coating application.
- 3.15 WOOD SURFACE PREPARATION
- A. Clean wood surfaces to be painted of all dust, dirt, grease, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, with either manual or mechanical means, as applicable, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of the priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic woodfiller. Sandpaper smooth when dried and dust off.
 - B. Prime or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood.
- 3.16 WORKMANSHIP
- A. Skilled craftsmen and experienced supervision shall be used on all work.
 - B. Clean drop cloths shall be used. All damage to surfaces resulting from the work hereunder shall be leaned, repaired, and refinished to the complete satisfaction of the ENGINEER, at no cost to the OWNER.
 - C. All coatings shall be applied under dry and dust-free conditions. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to ensure that they have been thoroughly cleaned and that they receive an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, alligating, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given to

ensure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other approved precautionary measures.

3.17 SHOP COATING REQUIREMENTS

- A. All items of equipment, or parts of equipment which are not submerged in service, shall be shop primed and then finish coated in the field after installation with the specified or approved color. The methods, materials, application, equipment and all other details of shop painting shall comply with these Specifications. If the shop primer requires top- coating within a specified period of time, the equipment shall be finish coated in the shop and then touch-up painted after installation.
- B. All items of equipment, or parts and surfaces of equipment which are submerged when in service, with the exception of pumps and valves shall have all surface preparation and coating work performed in the field.
- C. The interior surfaces of steel water reservoirs shall have all surface preparation and coating work performed in the field.
- D. For certain pieces of equipment, it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switch-gear or main control boards, submerged parts of the pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the specified quality in the field. Such equipment shall be shop primed and finish coated in the field with the identical material after installation. The CONTRACTOR shall require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these Specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.
- E. For certain small pieces of equipment, the manufacturer may have a standard coating system which is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.
- F. Shop painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 6 months before finish coating, or less time if recommended by the coating manufacturer.

- G. Damage to shop-applied coatings shall be repaired in accordance with this section and the coating manufacturer's printed instructions prior to finish painting.
- H. The CONTRACTOR shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment shop drawings.

3.18 APPLICATION OF COATINGS

- A. The application of protective coatings to steel substrates shall be in accordance with "Paint Application Specification No. 1", (SSPC-A-1), Steel Structures Painting Council.
- B. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The CONTRACTOR shall schedule such inspection with the ENGINEER in advance.
- C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be painted in the same working day.
- D. Coatings shall be prepared, mixed and applied in accordance with the manufacturer's instructions and recommendations, and these Specifications. If directions differ, the most stringent requirements shall be followed.
- E. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.
- F. Stir materials before application to produce a mixture of uniform density and stir as required during the application of the materials. Do not stir surface film into the coating materials. Remove the film, and if necessary, strain the material before using.
- G. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe (brushed or gloved) painting for these areas.
- H. Finish coats, including touch-up and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.
- I. Job Conditions: The following job conditions will be strictly enforced during the application of coatings for the project.

1. Apply water-base coatings only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F and 90 degrees F unless otherwise permitted by the paint manufacturer's printed instructions.
 2. Apply solvent-thinned coatings only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F and 95 degrees F unless otherwise permitted by the paint manufacturer's printed instructions.
 3. Do not apply paint in dust or smoke laden atmosphere, high winds, rain, fog or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.
 4. Do not apply coatings when the temperature is less than 5 degrees F above the dewpoint. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Weather Bureau psychometric tables.
 5. Do not apply coatings when the outside air temperature is expected to drop below 45 degrees F or less than 5 degrees F above the dewpoint, within 8 hours after application of the coating.
 6. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.
- J. The finish coat on all work shall be applied after all concrete, masonry, and equipment installation is complete and the work areas are clean and dust-free.
- K. General Considerations:
1. Apply paint as specified and in accordance with the manufacturer's directions. Use brushes for applying first coat on wood and on metals other than steel and sheet metal and items fabricated from steel and sheet metal. For other coats on wood, metal and other substrates, use applicators and techniques best suited for the type of material being applied.
 2. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Ensure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

3. Paint surfaces behind movable equipment the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment with prime coat only before final installation of equipment.
4. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
5. Paint the back sides of removable or hinged covers to match the exposed surfaces.
6. Finish exterior doors on tops, bottoms and side edges the same as the exterior faces, unless otherwise indicated or specified.
7. Sand lightly between each succeeding enamel coat.
8. Omit the field prime coat on shop-primed surfaces and touch up painted metal surfaces which are not to be finished painted and which will not be exposed to view in the completed work. Do not omit primer on metal surfaces specified to be finish coated or on metal surfaces that will be exposed to view in the completed work.

L. Scheduled Painting:

1. Apply the first coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings 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 the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

M. Minimum Coating Thickness: Apply each material at not less than the manufacturer's recommended spreading rate, to establish a total dry film thickness as specified or, if not specified, as recommended by coating manufacturer.

N. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces, and on the outside or exterior of buildings or structures:

1. Mechanical items to be painted include, but are not limited to, the following:
 - a. Piping, valves, pipe hangers, and supports.
 - b. Pumps

- c. Tanks
- d. Duct work, insulation
- e. Motors, mechanical equipment, and supports
- f. Accessory items

2. Electrical items to be painted include, but are not limited to, the following:

- a. Conduit and fittings
- b. Switchgear

- O. Prime Coats: Apply a prime coat to material, equipment and surfaces which are required to be painted or finished, and which have not been prime coated by others. Clean and prime unprimed ferrous metals as soon as possible after delivery of the metals to the job site. Recoat primed and sealed surfaces where there is evidence of suction spots or /unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- P. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surfaces imperfections.
- Q. Pigmented, Opaque Finishes: Completely cover to provide an opaque, smooth 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.
- R. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.19 CURING OF COATINGS

- A. The CONTRACTOR shall provide curing conditions in accordance with the conditions recommended by the coating material manufacturer or by these Specifications, whichever is the more stringent requirement, prior to placing the completed coating system into service.
- B. Forced Air Ventilation of Steel Reservoirs and Enclosed Hydraulic Structures: Forced air ventilation is required for the application and curing of coatings on the interior surfaces of steel reservoirs and enclosed hydraulic structures. During curing periods, continuously exhaust air from a manhole in the lowest shell ring or in the case of an enclosed hydraulic structure, from the lowest level of the structure using portable ducting. After all interior coating operations have been completed, provide a final curing period for a minimum of 10 days, during which time the forced air ventilation system shall operate continuously. For additional requirements, refer to the specific written instructions of the manufacturer for the coating system being applied.

3.20 COLOR CODING

- A. All exposed piping shall be color coded. After the finish coat has been applied, label each line with stenciled legends identifying the nature of the pipe contents and the direction of flow. This stenciled identification shall appear in one or more places in the line as deemed necessary by the ENGINEER. Stencil legends shall be white for all pipe except white color-coded pipe, which shall have black legends. Labels shall occur a minimum of every 15 feet of straight piping and at all bends. Minimum stencil size shall be two-inch letters for 4-inch and larger diameter piping and one-inch letters for 2-inch to 3-1/2-inch diameter piping. Piping 1-1/2-inch diameter and smaller shall be identified using plastic wrap-around pipe markers.
- B. Items to be coded but not specifically mentioned shall be coated in a color selected by the ENGINEER or OWNER.
- C. All paints/coatings used in potable water contact areas must have AWWA and EPA classification and approvals.
- D. All requirements of the Occupational Safety and Health Act (OSHA) concerning color coding and safety markings shall be considered part of these Specifications unless specifically excluded.
- E. Any paint/coating requirements/specifications not specifically addressed in the foregoing shall be decided upon as required by the ENGINEER.
- F. Every valve or connection, where it may be possible for a worker to be exposed to a hazardous substance, shall be labeled per General Industry Safety Orders, Article 112, OSHA Occupational Safety and Health Standards 29CFR1910.

3.21 COATING SYSTEM SCHEDULES

- A. COATING SYSTEM SCHEDULE, FERROUS METAL - NOT GALVANIZED (FM):

	Item	Surface Prep.	System No.
FM-1	All surfaces indoors and outdoors, exposed or covered, except those included below.	Commercial blast cleaning SSPC SP 6/NACE 3	(1) alkyd enamel or (3) epoxy/ polyurethane
FM-1	All surfaces indoors and outdoors, exposed or covered, except those included below.	Near white metal blast cleaning SSPC SP 10/NACE 2	(4) inorganic zinc/epoxy/polyurethane
FM-1	All surfaces indoors and	Manufacturer	(6) acrylic latex

	outdoors, exposed or covered, except those included below.	recommendation	
FM-2	Surfaces in chlorination room, chlorine storage room.	Commercial blast cleaning SSPC SP 6/NACE 3	(100) amine cure epoxy
FM-3	Surfaces of equipment and ferrous surfaces submerged or intermittently submerged in potable water, utility water, and wastewater including all surfaces lower than 2 feet above high water level in hydraulic structures, and all surfaces inside enclosed hydraulic structures and vents (excluding shop-coated valves, couplings, pumps).	White metal blast cleaning SSPC SP 5/NACE 1	(100) amine cure epoxy
FM-4	Surfaces exposed to high temperature (between 150 and 600 degrees F).	Near white metal blast cleaning SSPC SP 10/NACE 2	(5) inorganic zinc, water-based
FM-5	Surfaces exposed to high temperature (between 600 and 1000 degrees F).	Near white metal blast cleaning SSPC SP 10/NACE 2	(2) aluminum silicone
FM-6	Where indicated, ferrous surfaces in water passages of all valves 2-inch size and larger, exterior surfaces of submerged valves.	White metal blast cleaning SSPC SP 5/NACE 1	(101) polyamide epoxy
FM-7	Where indicated, ferrous surfaces in water passages and submerged surfaces of all pumps which have discharge size of 4 inches or larger.	White metal blast cleaning SSPC SP 5/NACE 1	(100) amine cure epoxy
FM-8	Ferrous surfaces of sleeve couplings.	Solvent cleaning SSPC SP 1, followed by white metal blast cleaning SSPC-SP 10/NACE 2	(103) fusion bond epoxy
FM-9	All ferrous surfaces of sluice gates, flap gates, and shear gates, including wall thimbles.	White metal blast cleaning SSPC SP 5/NACE 1	(101) polyamide epoxy
FM-10	Buried surfaces that are not	Near white metal blast	(100) amine cure epoxy

	indicated to be coated elsewhere.	cleaning SSPC SP 10/NACE 2	
FM-11	External surfaces of buried steel tanks.	White Metal blast cleaning SSPC SP 5/NACE 1	(100) amine cure epoxy
FM-12	Indoor architectural sheet metal, flashings, doors, frames, and exposed ducts	Commercial Blast Cleaning SSPC SP 6/NACE 3	(1) Alkyd Enamel
FM-13	Surfaces of indoor equipment, not submerged	Commercial blast cleaning SSPC SP 6/NACE 3	(7) epoxy, equipment

- B. COATING SYSTEM SCHEDULE, FERROUS METAL - GALVANIZED (FMG): All galvanized surfaces except for the following items shall be coated unless required by other Sections: (1) Floor gratings and frames, (2) Handrails, (3) Stair treads, (4) Chain link fencing and appurtenances.

	Item	Surface Prep.	System No.
FMG-1	All exposed surfaces indoors and outdoors, except those included below.	Solvent cleaning SSPC SP 1	(1) alkyd enamel or (3) epoxy/polyurethane
FMG-2	Surfaces in chlorinator room, chlorine storage room.	Solvent cleaning SSPC SP 1	(100) amine cure epoxy
FMG-3	Indoor architectural sheet metal, flashings, doors, frames, and exposed ducts	Solvent cleaning SSPC SP 1	(1) Alkyd Enamel
FMG-4	Surfaces buried or submerged in water or wastewater, including all surfaces lower than two feet above high-water level and all surfaces inside enclosed hydraulic structures and vents.	Solvent cleaning SSPC SP 1 followed by brush-off grade blast cleaning SSPC SP 7/NACE 4	(100) amine cure epoxy

- C. COATING SYSTEM SCHEDULE, NON-FERROUS METAL, PLASTIC, FIBERGLASS (NFM): Where isolated non-ferrous parts are associated with equipment or piping, the CONTRACTOR shall use the coating system for the adjacent connected surfaces. Do not coat handrails, gratings, frames or hatches. Only primers recommended by the coating manufacturer shall be used.

	Item	Surface Prep.	System No.
NFM-1	All exposed surfaces, indoors and outdoors, except those included below.	Solvent cleaned SSPC SP 1	(1) alkyd enamel or (4) epoxy/polyurethane
NFM-2	Chlorination room, chlorine storage room.	Solvent cleaned SSPC SP 1	(100) amine cure epoxy
NFM-3	Polyvinyl chloride plastic piping, indoors and outdoors, or in structures, not submerged.	Solvent cleaned SSPC SP 1	(6) acrylic latex

D. COATING SYSTEM SCHEDULE - CONCRETE AND CONCRETE BLOCK MASONRY (C):

	Item	Surface Prep.	System No.
C-1	All surfaces indoors and outdoors, where indicated.	Per paragraph 3.13	(9) acrylic, concrete or (104) polyurethane, concrete
C-2	Surfaces submerged in water or wastewater, including (a) between 2-feet above high water elevation and 2-feet below low water elevation in an open structure and (b) all surfaces above 2-feet below low water elevation in an enclosed structure.	Per paragraph 3.13	(104) polyurethane, concrete
C-3	Floor slab and walls, exposure to chemicals, where indicated.	Per paragraph 3.13	(104) polyurethane, concrete
C-4	Walls, floors, exposure to chemical splash, washdown, where indicated	Per paragraph 3.13	(104) polyurethane, concrete
C-5	Interior surfaces of sewer manholes, including sidewalls, bottom, and metal appurtenances, for manholes indicated.	Per paragraph 3.13	(105) epoxy, concrete

E. COATING SYSTEM SCHEDULE – MISCELLANEOUS SURFACES (MS):

	Item	Surface Prep.	System No.
MS-1	Wood, indoors and outdoors, and gypsum board indoors.	Per manufacturer's printed instructions	(200) acrylic

3.22 CLEAN-UP AND PROTECTION

- A. Clean Up: During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each workday. Upon completion of painting work, clean window glass and other paint-spattered surfaces located on site and off site. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- B. Protection: Protect work of other trades located on site and off site, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting.
 - 1. Provide "Wet Paint" signs, as required, to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
 - 2. At the completion of work of other trades, touch up and restore all damaged or defaced painted surfaces.

3.23 APPEARANCE AND INSPECTION

- A. All painting shall be accomplished in a workmanlike manner and shall be free of unsightly sags, runs, bubbles, drips, waves, laps, alligating, unnecessary brush marks and overspray or other physical defects and shall be uniform in color.
- B. The CONTRACTOR shall provide all rigging, scaffolding and other equipment necessary for a satisfactory inspection of a complete paint system and acceptance by the ENGINEER/OWNER.
- C. Inspection shall be conducted by an inspector selected by the ENGINEER/OWNER in the presence of the OWNER's representative and the CONTRACTOR or his representative. Provisions for calibrated and functional test equipment is the responsibility of the CONTRACTOR.
- D. The paint film shall be free of pinholes and holidays as determined by the use of an approved holiday detector as defined in Paragraph 1-09 of this Section.

- E. The paint film shall be randomly checked for dry film thickness as stipulated in the "Coating System" sections of these specifications. Thicknesses shall be checked with a properly calibrated and approved magnetic gauge as defined in Paragraph 1-09 of this Section.

3.24 REPAIR OF DEFECTS IN PAINT

- A. Any defects discovered during inspection, such as low film millage, holidays or pinholes, shall be repaired with the same materials as used for the original finish coat(s). Excessive low millage could require extra full coat(s) of paint.
- B. A final inspection will be conducted by the ENGINEER/OWNER or his representative after any necessary repairs and prior to final acceptance of the job.

3.25 DISINFECTION OF POTABLE WATER STORAGE TANKS

- A. Description: This paragraph specifies disinfection procedures for potable water storage tanks.
- B. Quality Assurance: The following documents are a part of this section as specified and modified. In case of conflict between the requirements of this paragraph and those of the listed documents, the requirements of this paragraph shall prevail.

Reference

Title

AWWA D105, latest revision

Disinfection of Water Storage Facilities

- C. Information to be Provided: Affidavit of Compliance as described in AWWA D105.
- D. After the tank has been painted and the interior surfaces have thoroughly dried, the CONTRACTOR shall remove all visible dirt and contaminating materials. The interior of the tank shall be disinfected in accordance with Chlorination Method 2 of AWWA D105. The CONTRACTOR shall furnish all of the chlorine required.
- E. The CONTRACTOR shall be responsible for obtaining proper disinfection as determined by bacteriological testing. Samples for bacterial analyses will be taken and analyzed by the OWNER. Two consecutive samples are required to pass the bacteriological tests for the tank to comply with these disinfection requirements.
- F. Water for filling the tank after the initial disinfection will be provided by the OWNER. If bacteriological testing shows the presence of coliform bacteria, the

tank shall be re-disinfected. The CONTRACTOR shall pay the OWNER for water required to fill the tank after the first filling at currently approved General Service water rates for the OWNER.

END OF SECTION

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SECTION 09 91 13
EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Galvanized metal.
 - 5. Exterior portland cement plaster (stucco).

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product Include preparation requirements and application instructions.
- B. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 3. VOC content.
- C. Quality Standard: Paint shall meet requirements of the Lee County Facilities Construction and Management Paint Specifications.
- D. Acceptable manufacturers include Benjamin Moore and Sherwin-Williams.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 5 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

- a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
- a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide

products by the following:

1. Sherwin Williams
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range.
1. 20 percent of surface area will be painted with deep tones.

2.3 BLOCK FILLERS

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

2.4 PRIMERS/SEALERS

- A. Primer, Bonding, Water Based: MPI #17.

2.5 METAL PRIMERS

- A. Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.
- B. Primer, Galvanized, Water Based: MPI #134.

2.6 WATER-BASED PAINTS

- A. Latex, Exterior Semi-Gloss (Gloss Level 5): MPI #11.
- B. Light Industrial Coating, Exterior, Water Based, Semi-Gloss (Gloss Level 5): MPI #163

2.7 TEXTURED AND HIGH-BUILD COATINGS

- A. Primer for Textured Coating, Latex, Flat: As recommended in writing by topcoat manufacturer.
- B. Intermediate Coat for Textured Coating, Latex, Flat: As recommended in writing by topcoat manufacturer.
- C. Textured Coating, Latex, Flat MPI #42.

2.8 DECK AND WALKWAY WATER REPELLANT

- A. Concrete Sealer Coating: MasterProtect H 400, Water based 40% Alkylalkoxysilane Penetrating Sealer
- B. Density 7.9 lbs/gal and 40% by Weight, apply per manufacturer's instructions.

2.9 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the

following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Portland Cement Plaster: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material

as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:

- a. Equipment, including panelboards and switch gear.
- b. Uninsulated metal piping.
- c. Uninsulated plastic piping.
- d. Pipe hangers and supports.
- e. Metal conduit.
- f. Plastic conduit.
- g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

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

3.6 EXTERIOR PAINTING SCHEDULE (Based on Sherwin Williams)

NOTE: Mils thickness is given in dry film thickness per coat.

- A. Concrete Surfaces
 - 1. Latex, Satin

- 1st Coat: Loxon Exterior Masonry Acrylic Primer, A24 Series (3.6 mils)
- 2nd Coat: A-100 Exterior Latex Satin, A82 Series (1.3 mils)
- 3rd Coat: A-100 Exterior Latex Satin, A82 Series (1.3 mils)
- Surfaces: Walls, ceilings, columns, soffits, etc.
- 2. Latex, Gloss
 - 1st Coat: Loxon Exterior Masonry Acrylic Primer, A24 Series (3.6 mils)
 - 2nd Coat: A-100 Exterior Latex Gloss, A8 Series (1.3 mils)
 - 3rd Coat: A-100 Exterior Latex Gloss, A8 Series (1.3 mils)
 - Surfaces: Walls, ceilings, columns, soffits, etc.
- B. Masonry Surfaces
 - 1. Latex, Satin
 - 1st Coat: Loxon Exterior Masonry Acrylic Primer, A24 Series (3.6 mils)
 - 2nd Coat: A-100 Exterior Latex Satin, A82 Series (1.3 mils)
 - 3rd Coat: A-100 Exterior Latex Satin, A82 Series (1.3 mils)
 - Surfaces: Masonry walls, graphics.
 - 2. Latex, Gloss
 - 1st Coat: Loxon Exterior Masonry Acrylic Primer, A24 Series (3.6 mils)
 - 2nd Coat: A-100 Exterior Latex Gloss, A8 Series (1.3 mils)
 - 3rd Coat: A-100 Exterior Latex Gloss, A8 Series (1.3 mils)
 - Surfaces: Masonry walls, graphics.
- C. Exposed Metal Surfaces
 - 1. Acrylic Alkyd, Semi-Gloss (Non-Galvanized Surfaces)
 - 1st Coat: Kem-Kromik Universal Primer, B50 Series (2.0 mils)
 - 2nd Coat: DTM Acrylic Semi-Gloss, B66 Series (3.0 mils)
 - 3rd Coat: DTM Acrylic Semi-Gloss, B66 Series (3.0 mils)
 - 2. Enamel, Gloss (Non-Galvanized Surfaces)
 - 1st Coat: Kem-Kromik Universal Primer, B50 Series (2.0 mils)
 - 2nd Coat: DTM Acrylic Semi-Gloss, B66 Series (3.0 mils)
 - 3rd Coat: DTM Acrylic Semi-Gloss, B66 Series (3.0 mils)
 - 3. Acrylic Alkyd, Semi-Gloss (Galvanized Surfaces)
 - 1st Coat: DTM Primer Finish, B66W1 Series (3.0 mils)
 - 2nd Coat: DTM Acrylic Semi-Gloss, B66 Series (3.0 mils)
 - 3rd Coat: DTM Acrylic Semi-Gloss, B66 Series (3.0 mils)
 - 4. Enamel, Gloss (Galvanized Surfaces)
 - 1st Coat: DTM Primer Finish, B66W1 Series (3.0 mils)
 - 2nd Coat: DTM Acrylic Semi-Gloss, B66 Series (3.0 mils)
 - 3rd Coat: DTM Acrylic Semi-Gloss, B66 Series (3.0 mils)
 - 5. Enamel, Gloss (Aluminum)
 - 1st Coat: DTM Primer Finish, B&IW00211 Acrylic (3.0 mils)
 - 2nd Coat: DTM Acrylic Semi-Gloss, B65W00721 Series (3.0 mils)
 - 3rd Coat: DTM Acrylic Semi-Gloss, B65W00721 Series (3.0 mils)
 - High-Build Acrylic Polyurethane Enamel – System A, Gloss
 - 1st Coat: Macropoxy 646, B58 Series (3.0 mils)

2nd Coat: Acrolon 218 HS Polyurethane Enamel, B65 Series (4.0 mils)

3rd Coat: Acrolon 218 HS Polyurethane Enamel, B65 Series (4.0 mils)

Surfaces: New metal railings surfaces, interior metal surfaces exposed to high humidity and moisture.

D. Exterior Exposed Wood Surfaces

1. Latex, Gloss, Paint

1st Coat: PrepRite Pro-Block Latex Primer, B51 Series (1.4 mils)

2nd Coat: A-100 Gloss Latex House & Trim, A8 Series (1.3 mils)

3rd Coat: A-100 Gloss Latex House & Trim, A8 Series (1.3 mils)

E. Stucco, Plaster and Manufactured Stone Surfaces

1. Latex, Satin

1st Coat: Loxon XP Exterior Masonry Acrylic Primer, A24 Series (3.6 mils)

2nd Coat: A-100 Satin Latex House & Trim, A80W00153 Series (1.3 mils)

END OF SECTION 09 91 13

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SECTION 09 91 23 - INTERIOR

PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Galvanized metal.
 - 5. Wood.
 - 6. Gypsum board.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85

degrees, according to ASTM D 523.

- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.1 ACTION SUBMITTALS

- A. Product Data: For each type of product Include preparation requirements and application instructions.
- B. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 3. VOC content.
- C. Quality Standard: Paint shall meet requirements of the Lee County Facilities Construction and Management Paint Specifications.
- D. Acceptable manufacturers include Sherwin-Williams and PPG

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than Insert number of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample

submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Sherwin Williams.
 - 2. H&C.
- B. Products: Subject to compliance with requirements, provide product listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.
 - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 7. Pretreatment Wash Primers: 420 g/L.
 - 8. Floor Coatings: 100 g/L.
 - 9. Shellacs, Clear: 730 g/L.
 - 10. Shellacs, Pigmented: 550 g/L.

- C. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Colors: As selected by Architect from manufacturer's full range.
 - 1. 20 percent of surface area will be painted with deep tones.

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.
 - 1. SW- Ultra 100% Latex Block Filler.

2.4 PRIMERS/SEALERS

- A. Primer Sealer, Interior, Institutional Low Odor/VOC:
 - 1. SW- Latex Drywall Primer.

2.5 METAL PRIMERS

- A. Primer, Rust-Inhibitive, Water Based:
 - 1. SW - Alkyd Metal Primer.
- B. Primer, Galvanized, Water Based: Comply with MPI #134.
 - 1. SW- Latex Surface Conditioner.

2.6 WATER-BASED PAINTS

- A. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5):
 - 1. SW- PRO Industrial Water Based Epoxy Semi-Gloss.

2.7 DRY FOG/FALL COATINGS

- A. Dry Fall, Latex, Flat: Provide per MPI #118.

2.8 DRY ERASE CLEAR GLOSS COATING

- A. Dry Erase Clear Gloss Coating, 2 component waterbased polyurethane. Sherwin Williams KB65C2000.

2.9 FLOOR COATINGS

- A. Stain, Interior, for Concrete Floors: MPI #58.
 - 1. For use at concrete floor of Mechanical and Tank Room. Provide H&C Colortop, Water-based Solid Color Concrete Stain. Or approved equal. Stain color to be grey except for Housekeeping pads which shall be yellow **(these pads shall be painted prior to placing equipment)**. Provide two coats as indicated by manufacturer.
- B. Sealer, Water Based, for Concrete Floors: Provide per MPI #99.

2.10 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials.

Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in
sharp lines and color breaks.

- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Surfaces,

1. Gloss Epoxy, Gloss

1st Coat: ProMar 200 Latex Wall Primer, B28 Series (3.0 mils)

2nd Coat: Water Based Catalyzed Epoxy, B70 Series (3.0 mils)

3rd Coat: Water Based Catalyzed Epoxy, B70 Series (3.0 mils)

Surfaces: Floors, walls, stairs, striping on floors, **Including** Tanks and Control Room floors and interior (all surfaces)

2. Latex, Satin

1st Coat: PrepRite Masonry Primer, B28 Series (3.0 mils)

2nd Coat: ProMar 400 Latex EG-Shel, B20 Series (1.6 mils)

3rd Coat: ProMar 400 Latex EG-Shel, B20 Series (1.6 mils)

Surfaces: Concrete walls, concrete ceilings (including precast), concrete locker bases.

B. Masonry Surfaces

1. Latex, Satin

1st Coat: ProMar Int/Ext Block Filler, B25 Series (8.0 mils)

2nd Coat: ProMar 200 Latex EG-Shel, B20 Series (1.6 mils)

3rd Coat: ProMar 200 Latex EG-Shel, B20 Series (1.6 mils)

Surfaces: Masonry walls, graphics.

2. Enamel, Gloss

1st Coat: ProMar Int/Ext Block Filler, B25 Series (8.0 mils)

2nd Coat: ProClassic Waterborne Gloss, B21 Series (1.3 mils)

3rd Coat: ProClassic Waterborne Gloss, B21 Series (1.3 mils)

Surfaces: Graphics.

3. Water Base/Epoxy (Gloss)

1st Coat: ProMar 200 Latex Wall Primer, B28 Series (3.0 mils)

2nd Coat: Water Based Catalyzed Epoxy, B70 Series (3.0 mils)

3rd Coat: Water Based Catalyzed Epoxy, B70 Series (3.0 mils)

Surfaces: Masonry walls, graphics.

C. Metal Surfaces

1. Acrylic, Gloss (Non-Galvanized)

1st Coat: DTM Acrylic Primer/Finish, B66 Series (3.0 mils)

2nd Coat: ProMar 200 Interior Latex Gloss Enamel, B21 Series (1.5 mils)

3rd Coat: ProMar 200 Interior Latex Gloss Enamel, B21 Series (1.5 mils)

2. Latex, Gloss (Galvanized)

1st Coat: DTM Primer Finish, B66W1 Series (3.0 mils)

2nd Coat: ProMar 200 Interior Latex Gloss Enamel, B21 Series (1.5 mils)

3rd Coat: ProMar 200 Interior Latex Gloss Enamel, B21 Series (1.5 mils)

Surfaces: Hollow metal doors, frames, railings, and ferrous metal surfaces.

D. Exposed Structure

1. Alkyd (Dry Fall-Out) Flat

1st Coat: S-W Super Save Lite Dryfall Flat, B48 Series, (*)

2nd Coat: S-W Super Save Lite Dryfall Flat, B48 Series, (*)

*Apply at film thickness necessary to achieve hiding and uniform luster.

E. Wood Surfaces

1. Water Base Enamel, Semi-Gloss

1st Coat: Wall & Wood Primer, B49 Series (1.9 mils)

2nd Coat: ProMar 200 Alkyd Semi-Gloss, B34 Series (1.7 mils)

3rd Coat: ProMar 200 Alkyd Semi-Gloss, B34 Series (1.7 mils)

Surfaces: Pegboard, etc.

2. Water Base Enamel, Gloss, Oil base paints not allowed

1st Coat: Wall & Wood Primer, B49 Series (1.9 mils)

2nd Coat: ProMar 200 Alkyd Gloss Enamel, B35 Series (1.6 mils)

3rd Coat: ProMar 200 Alkyd Gloss Enamel, B35 Series (1.6 mils)

Surfaces: All surfaces not factory finished or indicated otherwise.

F. Gypsum Wallboard Surfaces

1. Latex, Satin

1st Coat: PrepRite HB Wall Primer, B28 Series (1.6 mils)

2nd Coat: ProMar 400 Latex Eggshell, B31 Series (1.3 mils)

3rd Coat: ProMar 400 Latex Eggshell, B31 Series (1.3 mils)

Surfaces: Gypsum board walls, gypsum board ceilings, gypsum board bulkheads, graphics.

2. Water Base/Epoxy Gloss

1st Coat: ProMar 200 Latex Wall Primer, B28 Series (3.0 mils)

2nd Coat: Water Based Catalyzed Epoxy, B70 Series (3.0 mils)

3rd Coat: Water Based Catalyzed Epoxy, B70 Series (3.0 mils)

Surfaces: Gypsum board walls, gypsum board ceilings, gypsum board bulkheads, graphics.

G. Plaster Surfaces

1. Latex, Semi-Gloss

1st Coat: ProMar 200 Wall Primer, B49 Series (1.9 mils)

2nd Coat: ProMar 200 Latex Semi-Gloss, B31 Series (1.3 mils)

3rd Coat: ProMar 200 Latex Semi-Gloss, B31 Series (1.3 mils)

Surfaces: Plaster walls, plaster ceilings; plaster bulkheads, graphics.

2. Water Base/Epoxy (Gloss)

1st Coat: ProMar 200 Latex Wall Primer, B28 Series (3.0 mils)

2nd Coat: Water Based Catalyzed Epoxy, B45 Series (3.0 mils)

3rd Coat: Water Based Catalyzed Epoxy, B45 Series (3.0 mils)

Surfaces: Plaster walls, plaster ceilings; plaster bulkheads.

H. Veneer Plaster Surfaces

1. Latex, Matte

1st Coat: Digital Image Screen Paint, Ultra White Base Coat

2nd Coat: Digital Image Screen Paint, Ultra White Base Coat

3rd Coat: Digital Image Screen Paint, Ultra White Top Coat

4th Coat: Digital Image Screen Paint, Ultra White Top Coat

END OF SECTION 09 91 23

SECTION 10 53 00
ALUMINUM FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The bidding requirements, general conditions, supplementary conditions drawings and requirements of division one specification shall apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. The extent of aluminum framing is shown on the drawings and as specified herein.
- B. Definition: Extruded Aluminum Framing shall consist entirely of extruded aluminum sections (roll-formed not acceptable). System shall consist of heli-arc welded, one-piece rigid structural bents (column and beam assemblies), decking, fascia, accessory items and hardware to provide a complete system.
- C. Water shall drain from deck into designated beams and columns and discharge through weepholes below grade into pervious paving and/or connected to undergrade storm sewer system through pre-manufactured boot specified herein.

1.3 SUBMITTALS

- A. Shop Drawings: Submit detailed drawings, layout of walkway cover system, bent locations (identify drain columns and wet bents), all mechanical joint locations with complete details, connections, jointing and accessories. Include details of concrete footings and bent anchorage.
- B. Product Data: Submit manufacturer's product data, specifications, component performance data and installation instructions.
- C. Calculations: Provide signed and sealed structural calculations for the proposed walkway cover, by a professional engineer registered in the

state of Florida, who professes his discipline to be structural engineering.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following except as otherwise indicated:
 - 1. Standard Building Code, latest addition with amendments, if any.
 - 2. AWS (American Welding Society) standards for structural aluminum welding.
- B. Manufacturer: Obtain aluminum covered walkway system from only one (1) manufacturer, although several may be indicated as offering products complying with requirements.
- C. Installer Qualification: Firm with not less than three (3) years' experience in installation of aluminum walkway covers of type, quantity and installation methods similar to work of this section
- D. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to insure proper fitting of work. However, allow for adjustments within specified tolerations wherever taking of field measurements before fabrication might delay work.
- E. Shop Assembly: Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- F. Coordination: Coordinate work of this section with work of other sections which interface with covered walkway system (sidewalks, curbs, building fascias, etc.).

1.5 PERFORMANCE REQUIREMENTS:

- A. System Performance: Provide aluminum covered walkway system that has been designed, produced, fabricated and installed to withstand normal temperature changes as well as live loading, dead loading and wind loading in compliance with Standard Building Code requirements for geographic area in which work is located and as follows:
 - 1. Live Load: 30 p.s.f. minimum
 - 2. Structural design for wind forces: Comply with ANSI A58.1-1982
 - 3. Design Wind Velocity: 170 m.p.h.

4. Exposure: C
 5. Stability Criteria: Standard Building Code, Section 1205.3.
- B. Sizes shown on drawings are to be considered minimum.
- C. Structure shall be capable of sustaining severe icing, hail, hurricane force winds and supporting a concentrated load such as being walked upon.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Basis of Design: DITT-Deck Extruded Aluminum Walkway Cover System by Dittmer Architectural Aluminum.
- B. Alternate acceptable manufactures subject to compliance with this section:
1. Peach Tree Covers
 2. Rusco Custom Canopies
 3. Superior Metal Products Co.
 4. Architectural Metal Systems

2.2 MATERIALS

- A. All aluminum extrusions shall be alloy 6063 heat treated to a T-6 temper.
- B. Finishes:
1. Standard finish for extruded deck shall be satin anodize 204-R1 meeting Aluminum Association Specification AA-M-10C-22A-21. Aluminum Finish: CLEAR Anodized Aluminum AA-M10C22A41 Architectural Class I (.7 mils minimum) All anodic finishes shall meet the requirements of the Aluminum Association DAF-45 and AAMA 611 for anodized architectural aluminum.
- C. Fasteners:
1. Deck Screws (rivets not permitted): Type 18-8 non-magnetic stainless steel sealed with a neoprene "O" ring beneath 5/8" outside dimension, conical washer.
 2. Fascia Rivets: Size 3/16" by 1/2" grip range aluminum rivets with

- aluminum mandrel.
- 3. Bolts: All bolts, nuts and washers to be 18-8 non-magnetic stainless steel.
- 4. Tek Screws: not permitted

D. Warranty:

- 1. Manufacturer shall warrant the entire system against defects in labor and materials for a period of one (1) year commencing on the date of substantial completion as established in Division One of these specifications.
- 2. Intention of this warranty is the manufacturer will come onto the jobsite and do all necessary to effect corrections of any deficiencies.
- 3. Prima Facie Evidence of defects in labor and material may include but is not limited to, one or more of the following:
 - a. Moisture leaks
 - b. Metal failure including excessive deflection
 - c. Fastener failure
 - d. Finish failure

2.3 FABRICATION

- A. Comply with indicated profiles, dimensioned requirements and structural requirements.
- B. Use sections true to details with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, free from defects impairing strength and durability.
- C. All welding do be done by heli-arc process.
- D. Bents shall consist of shop welded one piece units. When size of bents do not permit shipment as welded unit, concealed mechanical joints may be used.
- E. Mechanical joints shall consist of stainless steel bolts with a minimum of two (2) bolts per fastening Bolts and nuts shall be installed in a concealed manner utilizing 1/2" thick by 1 1/2" aluminum bolt bars welded to structural members.
- F. All such mechanical joints must be detailed on shop drawings showing all locations.
- G. Roof Deck: Extruded Aluminum shapes, interlocking self-flashing sections.

Shop fabricate to lengths and panels widths required for field assembly. Depth of sections to comply with structural requirements. Provide shop induced camber in deck units with spans greater than 16'- 0" to offset dead load deflections. Welded dams are to be used at non-draining ends of deck.

- H. Expansion joints, design structure for thermal expansion and contraction. Provide expansion joints as required.
- I. Exposed rivets used to fasten bottom of fascia to deck to have finish to match fascia.
- J. Apply a shop applied dip-coat of clear acrylic enamel to each column end terminating in concrete to insulate from electrolytic reaction. Column ends shall be pierced to "key" grout to bent for maximum uplift protection.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING:

- A. Deliver, store and handle covered walkway system components as recommended by manufacturer. Handle and store in a manner to avoid deforming members and to avoid excessive stresses.

3.2 EXAMINATION

- A. Examine adjacent work for conditions that would prevent quality installation of system.
- B. Do not proceed until defects are corrected.

3.3 CONCRETE FOOTINGS

- A. Concrete footings are not work of this section. Refer to "concrete work", Section 033300.
- B. Sleeves (styrofoam blockouts) shall be furnished by walkway cover manufacturer and placed by general contractor.

3.4 FIELD DIMENSIONS

- A. General contractor shall field confirm bent locations, dimensions and elevations shown on shop drawings prior to fabrication.

3.5 INSTALLATION

- A. Erection: Set roof support frames (bents) into pockets provided in top of footings; set to required elevations, align, plumb and level; and grout in place with 2,000 p.s.i. portland cement grout. Assure that grout fills all voids and "keys" to columns. Fill downspout units with grout to bottom of discharge level. Install aluminum deflectors after grouting. Follow manufacturer's instructions. Match to finish and elevation of adjacent sidewalks.
- B. Install roof deck sections, accessories and related flashing in accordance with manufacturer's instructions. Provide roof slope for rain drainage without ponding water. Align and anchor roof deck units to structural support frames.
- C. Assemble all components in a neat, workmanlike manner.

3.6 FLASHING

- A. Flashings: Flashings required between covered walkway system and adjoining structures are not work of this section. Refer to "Flashing and Sheet Metals", Division 07.

3.7 CLEANING AND PROTECTION

- A. Damaged Units: Replace roof deck panels and other components of the work which have been damaged or have deteriorated beyond successful minor repair.
- B. Cleaning: Remove protective coverings at time in project construction sequence which will afford greatest protection of work. Clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.

END OF SECTION 10 53 00

SECTION 32 94 47 – FAUX FACTORY TRELLIS PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Trellis
- B. Fence and Gates
- C. Exterior Faux Landscape Panels.

1.2 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 10 22 13 – Wire Partitions.
- C. Section 32 31 - Fence and Gates
- D.

1.3 REFERENCES STANDARDS:

- A. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- B. ASTM A82 – Standard Specification for Steel Wire, Plain for Concrete Reinforcement
- C. ASTM A641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
- D. ASTM A879 – Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
- E. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
- F. ASTM A856/ A856M – Standard Specification for Zinc – 5% Aluminum Misch metal alloy coated steel wire.
- G. ASTM A123 – Standard Specification for Zinc (Hot Dip Galvanizing) Coatings on Steel Products.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate fabrication of metal mesh with fabrication of work on or in which the panels will be installed.
- B. Providing final size measurements to manufacture in time to avoid delay in the construction schedule.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Submit manufacturer's product data, standard details, details unique to this installation and installation instructions.
- C. Shop Drawings: Submit elevations and plan drawings indicating the following:
 - 1. Wire series and pattern name.
 - 2. Panel sizes and layout
 - 3. Panel thickness.
 - 4. Attachment bracket details.
- D. Verification Samples (as required): For each finish product specified, two samples, minimum size 9 inches square, represent actual product, color, and patterns.
- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- F. Warranty: Submit manufacture warranty and ensure that forms have been completed in Owner's name and registered with manufacturer. Warranty commences at date of Substantial Completion.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience. Having successfully completed projects within that time of similar size, complexity, and utilizing similar systems.
- B. Installer Qualifications: Experienced in performing work of this section that has specialized in installation of work similar to that required for this project.
- C. Mock-Up (as required): Provide a mock-up for evaluation of preparation techniques and installation workmanship.
 - 1. Locate in areas designated by Architect.
 - 2. Size: Minimum of 10 SF.
 - 3. Do not proceed with remaining work until materials and workmanship is approved by Architect.
 - 4. Rework mock-up as required to produce acceptable work.
 - 5. Retain mock-up during construction as quality standard.

6. Remove and legally dispose of mock-up when no longer needed.
7. Incorporation: Incorporate mock-up into final construction.

- D. Preinstallation Meetings (as required): Conduct meeting including Contractor, Architect, manufacturer, installer and other subcontractors whose work involves metal grille and screen systems to verify project requirements, framing and support conditions, mounting surfaces and manufacturer's installation requirements.
- E. Manufacturer's Representative: Manufacturer to provide on-site assistance during mock-up installation as well as initial stage of project installation. Refer to Section 2.1.A for Contact Information.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: **Green Smart Décor** - Phone: (312) 698.9085, Email: support@greensmartdekor.com
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 MATERIALS

- A. Green Smart Décor Panel System
 1. Cancun Panel System, See Drawings.
 2. Material: 10 gauge wire (0.135"). Select material below.
 3. Width and Length: W x L or (Refer to drawings).
 4. Grid Type: 3" x 3"
 5. Truss size: 3-inch deep. Truss is to be a ladder of corresponding size to the grid that maintains continuous contact with and welded to both front and back grid panels.
 6. Wire Gauge: 10 gauge (0.135").
 7. Tolerance: 1/4 inch in width and 1/4 inch in length.
- B. Finishes
 1. Stainless Steel, Type 304/ Type 316:

2.4 ATTACHMENT SYSTEMS CHAIN LINK FENCING

- A. Fence Post: Chain Link Fencings. Nut inserts (rivet nut inserts) to be factory installed for mounting panels to post.
- B. Fasteners for Mounting Panels to Fence Posts: a grade 5 1/4" - 20 Zink bolt, flat washer and nylock nut assembly, free from rust when salt spray tested for 300 hours in accordance with ASTM B117.
- C. TRIM
 - 1. Fabricate from 18 gauge (galvanized) steel plate, 90 degree break to form "C"
 - 2. TYPES
 - A. Channel Trim: Depth of Panel x 1" leg.
 - B. Angle Trim: 1/2" leg x 1" leg.
 - 3. LOCATIONS
 - A. Top of Faux Treillage (where Exposed to Pedestrians).
 - B. Side of Faux Treillage (where Exposed to Pedestrians).
 - C. Bottom of Faux Treillage (where Exposed to Pedestrians).

2.5 FABRICATION

- A. Fabricate Faux panels in accordance with approved shop drawings.
- B. Fabricate compatible attachment system to satisfy structural and performance requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine work area with installer present for compliance with site preparation and work of others required for successful installation of (trellis) (fence) (gate) (etc.).
- B. Verify dimensions, tolerances, and method of attachment with other work on-site.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Do not begin installation until openings and substrates have been properly

prepared to receive the products of this section.

3.2 PREPARATION

- A. Locate line of trellis or fence. Mark utilities, irrigation lines etc. Verify location with site survey if near site boundary or property line.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide suitable means of anchorage acceptable to manufacturer such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- C. Anchor supports securely with allowance for necessary thermal movement and structural support.
- D. Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- E. Do not install component parts that are observed to be defective, including warped, bowed, dented, abraded and broken members.
- F. Do not cut, trim, weld or braze component parts during erection in manner that would damage finish, decrease strength, or result in visual imperfection or failure in performance. Return component parts that require alteration to shop for reparation, if possible, or for replacement with new parts. Unless noted in drawings.
- G. Separate dissimilar metals and use gasketed fasteners, isolation shim, to eliminate possibility of corrosive or electrolytic action between dissimilar metals.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 SCHEDULES

- A. Schedule:

END OF SECTION

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SECTION 22 13 29

SUBMERSIBLE PUMPS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for furnishing and installing submersible pumping units, together with base elbows, guide rail systems, variable frequency drives, liquid level controls, control panels, access covers and all appurtenances necessary for a complete installation.
- B. Related Work Specified in Other Sections Includes:
 - 1. Section 09 90 00 - Painting

1.2 REFERENCES

- A. Codes and standards referred to in this section are:
 - 1. ASTM A 48 - Specification for Grey Iron Castings
 - 2. Hydraulic Institute Standards
 - 3. IEEE 82 - Test Procedure for Impulse Voltage Tests on Insulated Conductors
 - 4. NEC - National Electric Code
 - 5. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings
 - 6. ABMA 10 - Specifications for Metal Balls

1.3 SYSTEM DESCRIPTION

- A. General: Provide pumps of the vertical, centrifugal, heavy duty, nonclog, close-coupled, submersible type, each driven by submersible electric motor mounted as an integral part of the pump. Arrange the pumping equipment guide rails and base elbow for installation in the spaces shown without appreciable revision of the piping or structure. Design the pumping units for continuous and intermittent duty with ten starts per hour per pump.
- B. Operating Conditions: Provide pumps to operate at optimal efficiency at the capacities and heads and over the range of operating conditions specified without overloading, cavitation, and vibration.
- C. Pump Curve: Design each pump to have a continuously rising characteristic curve from the rating point to shutoff which passes through the rating point, and which

meets or exceeds the specified heads and capacities, all within the Hydraulic Institute tolerances.

- D. Provide submersible units capable of sustaining full reverse runaway speed without damage.

1.4 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. Shop Drawings: Submit working drawings, including arrangement and erection drawings of the equipment and equipment operating characteristics. Include the following:
 - 1. Pump performance curves. Draw the curves for the specified conditions including those at reduced speed. Plot head, input kilowatts, and overall efficiency, as a function of capacity from zero to maximum capacity.
 - 2. General arrangement drawing of pumping unit, base elbow and guide rail system. Include equipment weight and anchor methods and materials.
 - 3. Cross section drawing of pumping unit.
 - 4. Parts list with materials of construction identified.
 - 5. Motor performance characteristics.
 - 6. Spare parts list.
 - 7. Painting procedure.
- C. Quality Control Submittals: Submit 2 certified copies and 1 PDF of the Shop Test results.
- D. Operation and Maintenance: Submit the Operation and Maintenance manuals for the pumping equipment.

1.5 PUMP WARRANTY

- A. The pump manufacturer shall warrant the pumps being supplied against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. In addition, the manufacturer shall replace certain parts which shall become defective through normal use and wear on a progressive schedule of cost for a period of five (5) years; parts included are the seal, impeller, pump housing, wear ring, and bearings. The warranty shall be in published form and apply to all similar units.

1.6 QUALITY ASSURANCE

- A. Qualifications: Provide pumping equipment produced by a manufacturer who regularly engages in the design, manufacture, assembly and production of submersible pumping equipment of the size and type as specified for not less than five years.
- B. Regulatory Requirements: Rate the motor unit, and wet well wiring for service in hazardous Class 1, Division 1 locations.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle all products and materials as specified in Division 1.

1.8 PARTS

- A. Special Tools: Furnish a complete set of special wrenches, spanners, eyebolts and other special tools sufficient to completely dismantle and reassemble each kind and size of pumping unit. Provide tools of forged steel, case hardened, and full finished. Furnish the sets with a metal tool case with a handle and provision for padlocking.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers are listed in the LCU Approved Materials List.

2.2 GENERAL CONSTRUCTION

- A. Materials: Provide stainless steel fasteners, bolts, nuts and washers where exposed to the pumped liquid.
- B. Component Joints: Provide machined metal-to-metal joints on component parts that are assembled together. Fit with an "O"ring seal where watertight joints are required. Arrange the "O"ring seal for automatic compression and sealing without adjustment or bolt torquing procedures. Do not use flat gaskets or sealing compounds to obtain watertight joints. Furnish machined rabbet fits on component joints as required to provide automatic alignment of rotating parts.

2.3 CASING

- A. General: Provide pump casing of the centrifugal single volute, centerline discharge type. Do not use diffusion vanes.

- B. Materials: Construct pump casing of ASTM A48, Class 30B or 35B cast iron, or as shown on the plans.
- C. Wear Ring: Construct renewable wear rings of stainless steel.

2.4 IMPELLER

- A. General: Design impeller of the enclosed nonclog type. Provide pump-out vanes or a back ring, arranged with minimum clearances so as to preclude solids and stringy material from damaging the mechanical seal, on the back of the impeller.
- B. Materials: Construct the impeller of stainless steel.
- C. Balance: Dynamically balance the impellers.
- D. Wear Ring: Construct renewable impeller wear ring of brass.
- E. Assembly: Secure the impeller to the shaft with a stainless steel key and lock nut in such a way that it cannot unscrew or become loosened due to rotation in either direction.

2.5 OIL CHAMBER

- A. General: Provide an oil chamber to function as a buffer between the pumped liquid in the casing and the motor. Arrange the oil chamber to accommodate thermal expansion of the oil. Furnish an oil chamber drain plug that is accessible from outside the pump unit and permits changing oil without dismantling pump components.

2.6 MECHANICAL SEAL

- A. Design: Provide each pump with double tandem mechanical seals. Design the upper seal unit, between the oil chamber and motor housing, with one stationary tungsten- carbide ring and one positively driven rotating carbon ring. Design the lower seal unit, between the pump casing and oil chamber, with one stationary ring and one positively driven rotating ring. Furnish these rings made of tungsten-carbide. Use type 316 stainless steel for metal parts. Protect the spring element of the lower seal from solids contained in the pumped liquid. Do not rely upon the pumped liquid for lubrication. No seal damage is to result from operating the pumping unit out of its liquid environment. Conventional double mechanical seals with a single or double constant differential pressure to effect sealing and subject to opening and penetration by pumping forces will not be acceptable.

2.7 MOTOR

- A. General: Provide submersible pump motor of 230-volt, 3-phase, 60-hertz.

- B. Ratings: Design the motor to have suitable output torque and speed characteristic to start and operate the pump over the range of specified conditions. For constant speed pumping units do not exceed the nameplate horsepower rating under maximum load conditions. For pumping units operated from variable frequency drives, provide a motor nameplate horsepower rating at least 15 percent greater than the maximum load conditions. Base the nameplate horsepower rating on an 80 degrees C temperature rise above an ambient temperature of 40 degrees C. Design the motor for continuous load operation and continuous on-off cycling of ten starts per hour minimum without exceeding the 80 degree C temperature rise.
- C. Insulation: Provide the motor with a minimum of NEMA Class F (155 degrees C) moisture resistant insulation. Construct stator coils with NEMA Class F insulated winding wire. Apply impregnation resin to stator assembly in three dip and bake steps.
- D. Stator Housing: Provide the motor with an ASTM A48, Class 30B or 35B cast iron stator housing. For motors that employ cooling water jackets, design the water jacket passages to preclude clogging by solids contained in the pumped liquid.
- E. Cables: Provide the motor cable entry with a mechanical locking ring or compression type cord grip to protect the cable jacket from being pulled out of the motor. Do not use epoxy for this purpose. Arrange the cable entry so as to provide a watertight seal with a terminal board and terminations next to the motor. Isolate the cable entry leads from the internal motor leads to prevent entry of water into the motor chamber by leakage or wicking. Provide cables suitable for submersible pump application and conforming to NEC specifications for cable sizing. Provide permanent label on cables.
- F. Shaft
1. Design: Provide a one piece, fully machined pump and motor shaft. Design the shaft to limit shaft deflection under maximum pumping load to .002 inches at the lower mechanical seal face and to obtain a rotating assembly first critical speed of not less than 150 percent of the rated speed.
 2. Material: Provide shafts of either carbon steel or stainless steel. Protect carbon steel shafts from exposure to the pumped liquid by employing a stainless steel sleeve or chrome plating.
- G. Bearings
1. Design: Provide two anti-friction bearing assemblies. Design one assembly to carry only radial loads and to be free to float axially within the frame. Design the other assembly to carry both radial and axial loads and to be restrained from axial movement.

2. Bearing Life: Select bearings in accordance with AFBMA 9 and AFBMA 10, Load Ratings and Fatigue Life for Ball and Roller Bearings, to have a 20,000 hours minimum L10 bearing life at maximum pumping load that occurs under the specified operating conditions.

2.8 PROTECTION MONITORING SYSTEM

- A. General: Provide each pumping unit with a monitoring system to protect critical machine functions during operation.
- B. Motor Winding Temperature: Provide three thermostats, one per phase, to protect against overheating. Initiate an alarm and motor shutdown on high temperature.
- C. Automatic Megger: All pumps 294 watt (30 HP) and larger shall be furnished and installed with one (1) completely enclosed solid state electronics module (automatic megger) to automatically monitor the motor winding resistance on each pump. Each automatic megger must have an individual disconnect terminal plug and manual shut off switch. Each automatic megger must have three (3) lights to indicate 10 M ohm, 5 M ohm, and 1 M ohm resistance values. Power source to be 110 VAC fused at ¼ amp. The D.C. test volt to be 500 to 700 volts. The output current to be limited to less than 1 micro amp. Must also have two (2) output circuits for external alarms. When the motor resistance drops to 1 M ohm, an alarm system must be activated by the internal circuit of the automatic megger. The automatic megger must monitor the motor resistance only when the motor is off. Each automatic megger must also include two (2) switches for manual testing. The automatic megger shall be of an approved manufacture (see LCU Approved Materials List).
- D. Sensor Monitoring Device: Provide a monitoring device or devices designed to be compatible with the sensors and motor controls. Locate monitoring devices in control panel.

2.9 GUIDE RAIL SYSTEM AND BASE ELBOW

- A. Design: Provide each pump with a base elbow and guide rail system. Design the guide rail system to permit installation and removal of the pump from its base elbow discharge connection without requiring personnel to enter the wet well.
- B. Guide Rail System: Provide a guide bracket which is an integral part of the pump casing and permits sliding the pumping unit, along two unthreaded 316 stainless steel guide rails. Provide the guide rails of 316 stainless steel pipe connected to the base elbow at the bottom. Support the guide rails at intermediate locations and at the top with stainless steel brackets bolted to the wall of the wet well or

concrete slab. Fit each pump with a 316 stainless steel cable of adequate length and strength to permit the raising and lowering of the pump for inspection and removal.

- C. Base Elbow: Provide a cast iron base elbow arranged for automatic pump connection. Provide the pump casing with a machined discharge flange which, when the pump is lowered into the pumping position, will automatically align and mate with the plain end of the base elbow. Design the discharge connection such that no motion other than vertical is required to seat the mating flange of the casing to the base elbow. Accomplish sealing of the pump connection by metal-to-metal contact or by a positive resilient seal of Buna-N attached to the pump casing discharge flange. Design the base elbow to support the weight of the pumping unit and prevent it from bearing directly on the wet well floor.
- D. Mounting Accessories: Provide anchor bolts, nuts, washers, and accessories and other adapter equipment necessary for mounting the pumping equipment and appurtenances. Construct anchor bolts, nuts, washers, accessories and adaptor equipment of 316 stainless steel. Provide 3/8-inch minimum 316 stainless steel chain a minimum of 20 inches long attached to a minimum 1/4-inch minimum 316 stainless steel wire rope which is to be hung on a 316 stainless steel rack at the top of the wet well.

2.10 OPERATION AND CONTROL

- A. See Section 16160 for control panel requirements.
- B. Each pumping station control system shall include appropriate sensors liquid level and provide appropriate signals to the logic circuits to produce the required mode of operation for the pumping facilities.
- C. Any levels sensing and control system must be approved by OWNER. Capability shall be provided for manual start-stop control for all pumping units as well as the normal automatic control from the logic circuits. A high water level, non-loathing alarm system shall be provided. Each sewage pump shall be provided with an elapsed time meter to indicate pump running time. The submersible station controls shall be housed within an exterior panel, pole-mounted or free-standing enclosure. The panel will include double dead front outer doors fitted with hoop and padlock master keyed to County standard.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install all equipment in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1. Complete all wiring and piping and make all necessary adjustments to equipment to provide a complete operational pumping installation.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Furnish the services of a qualified representative of the manufacturer to provide instruction on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment and place the equipment in trouble-free operation, as specified in Division 1.
- B. Tests: After installation of the pumping units, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions. Perform the field tests in the presence of and as directed by the ENGINEER. Demonstrate that under all conditions of operation each unit:
 - 1. Has not been damaged by transportation or installation.
 - 2. Has been properly installed.
 - 3. Has no mechanical defects.
 - 4. Has been properly connected.
 - 5. Is free of overheating of any parts.
 - 6. Is free of overloading of any parts.

Test the pumps to demonstrate that the pumps and control system operate as specified. Promptly correct any defects in the equipment or failure to meet the requirements of the Specifications.

Conduct 24 hours of continuous operation test prior to acceptance.

3.3 CLEANING AND PAINTING

- A. Paint as specified in Section 09 90 00.

END OF SECTION

SECTION 26 05 02

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: General requirements for providing basic electrical materials and methods.
- B. Related Work Specified in Other Sections Includes:
 - 1. Certain items of equipment, and various control devices including conduit and wiring which are indicated on electrical drawings to be connected, but are specified in other sections pertaining to plumbing, heating, ventilating, air conditioning, temperature control systems, process equipment, process control systems, and instrumentation. Install and connect these items to the electrical system as indicated or required in accordance with the Contract Documents.
- C. Overall Application of Specifications: This Section applies to all sections of Division 26 and to other sections that include electrical equipment requirements except when in these individual sections requirements are otherwise specified to provide and install all materials necessary for a complete operational system.
- D. Temporary Requirements: This Section applies to any temporary circuits, overcurrent devices, conduit, wiring, and other equipment required during changeover from existing to a new electrical system. This Section also applies to temporary rewiring of lighting and power circuits, instruments and devices.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements: Design requirements are specified in the applicable sections.
- B. Performance Requirements: Performance requirements are specified in the applicable sections.

1.3 SUBMITTALS

- A. General: Provide submittals for all electrical material and devices. Including the following:
1. Submit Technical Information Brochures at start of construction or within 30 days after Award of the Contract.
 2. First sheet in the brochure shall be a photocopy of the Electrical Index pages in these specifications. Second sheet shall be prepared by the Contractor, and shall list Project Addresses and phone numbers with key personnel for this project.
 3. Provide reinforced separation sheets tabbed with the appropriate specification reference number.
 4. The General Contractor shall review the brochures before submitting to the Engineer. No request for payment will be considered until the brochure has been submitted and reviewed completely.
 5. Submit cost breakdown "Schedule of Values" for electrical work in the Technical Information Brochures. Cost of material and labor for each major item shall be shown.
 6. Acceptance: When returned to Contractor, submittals will be marked with Engineer's stamp. If box marked "returned for correction resubmit" is checked, submittal is not approved and Contractor is to correct and resubmit as noted, otherwise submittal is approved and Contractor is to comply with notation making necessary corrections on submittal and resubmit for final record.
 7. Note that the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Approval of shop drawings does not invalidate the plans and specifications if in conflict with the submittal. It is the contractor's responsibility to request in writing and seek written approval from the engineer for all deviations of the plans and

specifications.

- B. Product Data and Information: Provide complete list of electrical equipment and materials to be furnished showing manufacturer, catalog number, size, type, voltage rating and other pertinent information.
1. Provide catalog data on manufacturer's standard equipment and materials. Clearly indicate on catalog cuts the equipment and devices being proposed.
 2. Identification: Provide complete schedule and listing of system and equipment identification labels with legends.
 3. Material shall not be ordered or shipped until the shop drawings have been approved.
 4. The Engineer's shop drawing review shall be for conformance with the design concept of the project and compliance with the Specifications and the Drawings. Errors and omissions on approved shop drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by the Specifications and the Drawings.
 5. Shop drawings shall be stamped with the date checked by the contractor and a statement indicating that the shop drawings conform to the Specifications and the Drawings. This statement shall also list all exceptions to the Specifications and the Drawings. Shop drawings not so checked and noted shall be returned.
- C. CONTRACTOR's Shop Drawings: Provide shop drawings on items manufactured for the Contract.
1. Provide connection diagram and schematic for each piece of electrical equipment. A manufacturer's standard connection diagram or schematic showing more than one method of connection is not acceptable unless it is clearly marked to show the intended method of connection.
 2. Provide diagrams showing connections to field equipment. Clearly differentiate between manufacturer's wiring and field wiring.
 3. Provide raceway layout drawings showing conduits, boxes, and

panels which contain the conductors to be provided. Include schedules listing conduit sizes and conductor content and identification.

4. Where additions and modifications are made to existing equipment, provide drawings which include both retained existing equipment and new Work.
- D. Coordination Drawings: Prepare to scale coordination drawings (1/4"=1'-0"); detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including but not necessarily limited to the following:
1. Indicate the proposed locations of major raceway systems, equipment, and materials. All dimensions shall be field verified at the job site and coordinated with the work of all other trades. Include the following:
 - a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
 - b. Exterior wall and foundation penetrations.
 - c. Fire-rated wall and floor penetrations.
 - d. Equipment connections and support details.
 - e. Sizes and location of required concrete pads and bases.
 2. Record Documents: Prepare record documents, and in addition to the requirements specified in Division 1. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, (the "Record Drawings"). Indicate installed conditions for:
 - a. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.

- b. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - c. Approved substitutions, and actual equipment and materials installed.
 - d. Record Drawings shall accurately show the installed condition of the following items: Power Riser Diagram(s). Equipment elevations (front views). Raceways and pullboxes. Conductor sizes and conduit fills. Control Wiring Diagram(s). Underground raceway and duct bank routing. Plan view, sizes and locations of distribution transformers and outdoor electrical equipment enclosure.
 - e. Submit a schedule of control wiring raceways and wire numbers, including the following information: Circuit origin, destination and wire numbers. Field wiring terminal strip names and numbers.
 - f. In addition to the schedule, provide point to point connection diagrams showing the same information submitted in the schedule of control wiring raceways including all designations and wire numbers. Comply with PLC tag designation on all instrumentation and control cabling in and out of PLC racks.
 - g. The schedule of control wiring raceways and wire numbers and the point to point connection diagrams shall be in electronic Autocad and Word format (i.e. no hand-written or drawn schedules, drawings, or diagrams will be accepted)
- E. Operation and Maintenance Manuals: Prepare operation and maintenance manuals, and in addition to the requirements specified in other Divisions, include the following information for equipment items:
- 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and catalog numbers of replacement parts. Complete parts list with stock numbers, including spare parts. A complete bill of material supplied, including serial numbers, ranges and pertinent data.
 - 2. Manufacturer's printed operating procedures to include start-up,

break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. A comprehensive index.
5. A complete "As Built" set of approved shop drawings.
6. A table listing of the "as left" settings for all timing relays and alarm and trip setpoints. A complete listing of As left programmable parameters for all drives, soft-starters and other microprocessor controlled equipment.
7. System schematic drawings "As Built", illustrating all components, piping and electric connections of the systems supplied under this Section.

1.4 QUALITY ASSURANCE

- A. Codes: Provide all electrical Work in accordance with applicable local codes, regulations and ordinances. If there is a conflict between the requirements specified in the Contract Documents and the codes, follow the more stringent requirements as determined and approved.
- B. Testing: As a minimum, provide standard factory and field tests for each type of equipment. Other tests may be specified in the applicable equipment section.
- C. Labeling: Provide all electrical equipment and materials listed and approved by Underwriters Laboratories with the UL label or other OSHA recognized testing laboratories attached to it.
- D. Standard Products: Unless otherwise indicated, provide electrical materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these

Specifications. When two or more units of the same class of material and equipment are required, provide the products of the same manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:
- B. Shipping and Packing: Provide materials and equipment suitably boxed, crated or otherwise completely enclosed and protected during shipment, handling, and storage. Clearly label such boxes, crates or enclosures with manufacturer's name, and name of material or equipment enclosed.
- C. Acceptance at Site: Conform to acceptance requirements as required in Division
1. Repair or replace all materials and equipment damaged by handling and storage as directed at no additional Contract cost.
- D. Storage and Protection: Protect materials and equipment from exposure to the elements and keep them dry at all times. Handle and store to prevent damage and deterioration in accordance with manufacturer's recommendations.

1.6 PROJECT CONDITIONS

- A. General: The Drawings indicate the extent and general arrangement of the principal electrical elements, outlets and circuit layouts. Connect and install all electrical elements and devices to form a workable system as required by the Contract Documents whether the connections and installations are specifically stated in the Specifications or shown. Provide necessary materials and installation wherever required to conform to the specific requirements of the furnished equipment and for proper installation of the Work.
- B. Schematics: In general the runs of feeders are shown schematically and are not intended to show exact routing and locations of raceways. Verify actual and final arrangement, equipment locations, and prepare circuit and raceway layouts before ordering materials and equipment. Equipment locations are approximate and are subject to modifications as determined by equipment dimensions.

- C. Coordination of Work: Coordinate the Work so that the electrical equipment may be installed without altering building components, other equipment or installations.
- D. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow the right of way for piping and conduit installed at the required slope.
 - 4. To clear connecting raceways, cables, wireways, cable trays, and busways of obstructions and of the working and access space of other equipment.
- E. Coordinate the installation of required supporting devices and set sleeves in cast- in-place concrete, masonry walls, and other structural components as they are constructed.
- F. Coordinate electrical testing of electrical, mechanical, and architectural items, so that functionally interdependent equipment and systems demonstrate successful interoperability.
- G. Departure from Design: If departures are deemed necessary due to structural conditions, obstructions or other problems, provide details of such departures and the reasons for requesting approval as soon as practicable but not later than the submittal of the raceway layout drawings. Do not make any departures without written approval.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 ROUGH-IN

- A. Final Location: Verify final locations for rough-ins with field measurements, vendor shop drawings and with the requirements of the actual equipment to be connected.
- B. The Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.
- C. Install each 3 phase circuit in a separate conduit unless otherwise shown.
- D. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.
- E. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
- F. All junction box hardware to be aluminum or stainless steel only.

3.2 ELECTRICAL INSTALLATIONS

- A. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate electrical systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.
 - 3. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

4. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
5. Coordinate the installation of required supporting devices and sleeves to be set in cast-in-place concrete and other structural components, as they are constructed.
6. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
7. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
8. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
9. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the ENGINEER for resolution.
10. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
11. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
12. Install access panel or doors where units are concealed behind finished surfaces.

13. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- B. Homeruns: Drawings show most homerun circuits to be provided. Do not combine power or control circuits into common raceways without authorization of Engineer. Changes shall be documented on record drawings. Homerun circuits shown on Drawings indicate functional wiring requirements for all circuits. Lighting and receptacle Circuits; no more than three circuits to a single raceway. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.

3.3 CUTTING AND PATCHING

- A. Perform cutting and patching as specified in Division 1. In addition to the requirements specified in Division 1, the following requirements apply:
1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Locate existing structural reinforcing where core drilled penetrations are required so as not to cut the steel reinforcing.
 2. Cut, remove, and properly dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work. Deliver all the existing removed to the OWNER as directed.
 3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
6. Patch finished surfaces and building components using new materials as specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:
Requirements that apply to all sections of Division 26.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:
Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS:
Conduits for conductors and cables.

1.3 QUALITY ASSURANCE

- A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
 - 1. Shop Drawings:
 - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - b. Submit the following data for approval:
 - 1) Electrical ratings and insulation type for each conductor and cable.

- 2) Splicing materials and pulling lubricant.
- 2. Certifications: Two weeks prior to final inspection, submit the following.
 - a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
 - b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.
- B. American Society of Testing Material (ASTM):
 - D2301-10.....Standard Specification for Vinyl Chloride
Plastic Pressure-Sensitive Electrical Insulating Tape
 - D2304-10.....Test Method for Thermal Endurance of Rigid
Electrical Insulating Materials
 - D3005-10.....Low-Temperature Resistant Vinyl Chloride
Plastic Pressure-Sensitive Electrical Insulating Tape
- C. National Electrical Manufacturers Association (NEMA):
 - WC 70-09.....Power Cables Rated 2000 Volts or Less for the
Distribution of Electrical Energy
- D. National Fire Protection Association (NFPA):
 - 70-17.....National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
 - 44-14.....Thermoset-Insulated Wires and Cables
 - 83-14.....Thermoplastic-Insulated Wires and Cables
 - 467-13.....Grounding and Bonding Equipment
 - 486A-486B-13.....Wire Connectors
 - 486C-13.....Splicing Wire Connectors
 - 486D-15.....Sealed Wire Connector Systems
 - 486E-15.....Equipment Wiring Terminals for Use with
Aluminum and/or Copper Conductors
 - 493-07.....Thermoplastic-Insulated Underground Feeder and Branch
Circuit Cables

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Conductors and cables shall be in accordance with ASTM, NEMA, NFPA, UL, as specified herein, and as shown on the drawings.
- B. All conductors shall be copper.
- C. Single Conductor and Cable:
 - 1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
 - 2. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.
- D. Direct Burial Cable: UF or USE cable.

2.2 SPLICES

- A. Splices shall be in accordance with NEC and UL.
- B. Above Ground Splices for No. 10 AWG and Smaller:
 - 1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
 - 2. The integral insulator shall have a skirt to completely cover the stripped conductors.
 - 3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
 - 1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
 - 2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
 - 3. Splice and insulation shall be product of the same manufacturer.
 - 4. All bolts, nuts, and washers used with splices shall be //zinc-

plated//cadmium-plated// steel.

D. Above Ground Splices for 250 kcmil and Larger:

1. Long barrel “butt-splice” or “sleeve” type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.

E. Underground Splices for No. 10 AWG and Smaller:

1. Solderless, screw-on, reusable pressure cable type, with integral insulation. Listed for wet locations, and approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped conductors.
3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

F. Underground Splices for No. 8 AWG and Larger:

1. Mechanical type, of high conductivity and corrosion-resistant material. Listed for wet locations, and approved for copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.//

G. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

2.3 CONNECTORS AND TERMINATIONS

- A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
- B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire,

listed for use with copper and aluminum conductors.

- C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be //zinc- plated//cadmium-plated// steel.

2.4 CONTROL WIRING

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5 WIRE LUBRICATING COMPOUND

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.
- B. Shall not be used on conductors for isolated power systems.

PART 3 – EXECUTION

3.1 GENERAL

- A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.
- B. Install all conductors in raceway systems.
- C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.
- D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non- metallic ties.
- G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
- H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.
- I. Conductor and Cable Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
 2. Use nonmetallic pull ropes.
 3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
 4. All conductors in a single conduit shall be pulled simultaneously.
 5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- J. No more than three branch circuits shall be installed in any one conduit.
- K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2 INSTALLATION IN MANHOLES

- A. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.
- B. Fireproofing:
1. Install fireproofing on low-voltage conductors where the low-voltage conductors are installed in the same manholes with medium-voltage conductors.
 2. Use fireproofing tape as specified in Section 26 05 13, MEDIUM-VOLTAGE CABLES, and apply the tape in a single layer, half-lapped, or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (1 inch) into each duct.
 3. Secure the fireproofing tape in place by a random wrap of glass cloth tape.

3.3 SPLICE AND TERMINATION INSTALLATION

- A. Splices and terminations shall be mechanically and electrically secure and tightened to manufacturer's published torque values using a torque screwdriver or wrench.
- B. Where the EOR determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the CUSTOMER.

3.4 CONDUCTOR IDENTIFICATION

- A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

3.5 FEEDER CONDUCTOR IDENTIFICATION

- A. In each interior pullbox and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

3.6 EXISTING CONDUCTORS

- A. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.7 CONTROL WIRING INSTALLATION

- A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.
- B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

3.8 CONTROL WIRING IDENTIFICATION

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.9 DIRECT BURIAL CABLE INSTALLATION

- A. Tops of the cables:
 1. Below the finished grade: Minimum 600 mm (24 inches) unless greater depth is shown.
 2. Below road and other pavement surfaces: In conduit as specified, minimum 760 mm (30 inches) unless greater depth is shown.

3. Do not install cables under railroad tracks.
- B. Under road and paved surfaces: Install cables in concrete-encased galvanized steel rigid conduits. Size as shown on plans, but not less than 50 mm (2 inches) trade size with bushings at each end of each conduit run. Provide size/quantity of conduits required to accommodate cables plus one spare.
- C. Work with extreme care near existing ducts, conduits, cables, and other utilities to prevent any damage.
- D. Excavation and backfill is specified in Section 31 20 00, EARTH MOVING. In addition:
 1. Place 75 mm (3 inches) bedding sand in the trenches before installing the cables.
 2. Place 75 mm (3 inches) shading sand over the installed cables.
 3. Install continuous horizontal 25 mm by 200 mm (1 inch x 8 inches) preservative-impregnated wood planking 75 mm (3 inches) above the cables before backfilling.
- E. Provide horizontal slack in the cables for contraction during cold weather.
- F. Install the cables in continuous lengths. Splices within cable runs shall not be accepted.
- G. Connections and terminations shall be listed submersible-type designed for the cables being installed.
- H. Warning tape shall be continuously placed 300 mm (12 inches) above the buried cables.

3.10 ACCEPTANCE CHECKS AND TESTS

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
 1. Visual Inspection and Tests: Inspect physical condition.
 2. Electrical tests:
 - a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase- to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
 - b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is

constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.

- c. Perform phase rotation test on all three-phase circuits.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.

1.2 SCOPE

- A. Provide all material, labor and incidentals necessary for the completion of this section of the work.

1.3 RELATED WORK

- A. Section 26 05 02 – Basic Electrical Materials and Methods
- B. Section 26 05 33 – Raceways and Boxes for Electrical Systems

1.4 QUALITY ASSURANCE

- A. Follow the requirements of the following regulatory agencies:
 - 1. National Fire Protection Association (NFPA, NFPA-70 – National Electrical Code (NEC) and Wisconsin amendments thereto.
 - 2. Local Codes and Ordinances

1.5 REFERENCE STANDARDS

- A. Conform to the standards of the National Electrical Contractors Association (NECA), Standard of Installation.

PART 2 – PRODUCTS

2.1 GROUND CLAMPS

- A. Ground clamp fittings shall be interlocking clamp type fabricated from high strength corrosion-resistant metal with high strength silicon bronze U-bolt, nuts and lock washers.

2.2 GROUND RODS

- A. Thick copper covering inseparably welded to a strong steel core.
- B. $\frac{3}{4}$ in. diameter minimum.
- C. Ten-feet long minimum.

2.3 GROUND WIRES

- A. Copper only.
- B. Size as shown on drawings, or as required by NEC.
- C. C. No. 6 AWG minimum.

PART 3 – EXECUTION

3.1 GENERAL

- A. Ground electrical systems and equipment as required by code, utility, local ordinances and to requirements herein.
- B. Install separate code rated grounding conductors to special equipment and activity areas as required by code.
- C. Bond all metallic piping systems and service equipment as required by NEC.
- D. Cable connections and joints shall be thermo-welded.

3.2 SYSTEM GROUND

- A. Attach grounding electrode conductor to point ahead of water meter or service shut-off valve. Grounding electrode conductor shall be permitted to be attached to other grounding electrodes where available in the building as defined in NEC Article 250-81 in lieu of attaching to water service.
- B. Water piping system ground shall be augmented by 2 NEC approved grounding electrodes so as to achieve an effective ground resistance as required by code and as shown on the plans. Building steel shall be used where available.
- C. Drive ground rods to a depth of 4 inches below finished grade.
- D. Grounding electrode conductor.
 - 1. Continuous without splice from nearest building grounding electrode. Ground to service equipment.
 - 2. Install bonding jumper around water meter.

3. Install in rigid metal conduit securely fastened to pipe.
4. Attach non-ferrous metal tag to warn against removal.
5. Make connections to ground electrodes with approved molded exothermic weld process.

3.3 EQUIPMENT GROUND

- A. Bond metallic conduits, supports, cabinets and other equipment so ground will be electrically continuous from service to outlet boxes.
- B. Install grounding conductor in nonmetallic and flexible conduit to complete equipment ground continuity. Ground wire shall be bonded at equipment and at first junction box of conduit system on line side of flexible conduit to the system.
- C. Install grounding conductors to permit shortest and most direct path from equipment to ground. When grounding conductor runs through metallic conduit, bond to conduit at entrance and exit with a bolted clamp.
- D. Ground neutral at service only.
- E. Install an insulated equipment grounding conductor in each conduit. Conduit will not be relied upon as the grounding path.
- F. Provide an insulated dedicated green equipment grounding conductor (in addition to equipment grounding conductor) with all circuits serving isolated ground receptacles (connected to isolated ground terminal on device).
- G. Green ground bar in panels, where required to be similar to neutral bar, except tinted green and isolated from panel tub.
- H. Connections shall be accessible for inspection and checking. No insulation shall be installed over ground connections.
- I. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
- J. Attach grounds permanently before permanent building service is energized.
- K. Ground metal lighting poles. Install a ground lug on wall of pole directly across from handhole.
- L. Attach ground wire neatly and firmly to walls.

3.4 FIELD QUALITY CONTROL

- A. Contractor shall make ground resistance measurements. Measure in normally dry conditions, not less than 48 hours after rainfall.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.

1.2 SCOPE

- A. Provide conduit systems, boxes and fittings for all power wiring and communication systems as specified.

1.3 RELATED WORK AND REQUIREMENTS

- A. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
- B. Section 26 05 26 – Grounding and Bonding for Electrical Systems
- C. Section 26 27 26 – Wiring Devices.

1.4 QUALITY ASSURANCE

- A. National Electrical Contractor's Association (NECA) Standard of Installation
- B. National Electrical Code (NEC) including State of Wisconsin and local supplements.

PART 2 – PRODUCTS

2.1 GALVANIZED RIGID CONDUIT (GRC) AND INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufactured lengths, full weight, heavy wall, rigid steel conduit, protected inside and out by hot-dipped galvanized or electro-galvanized coating.
- B. Minimum conduit size shall be ½ inch.
- C. Connectors and Couplings
 - 1. Threaded.
 - 2. Liquid tight.

3. Insulated throat.

2.2 ELECTRICAL METALLIC TUBING (EMT)

- A. Standard lengths and sizes.
- B. Minimum conduit size shall be ½ inch.
- C. Connectors and Couplings
 - 1. Threaded with insulated throat for box connections.
 - 2. Gland compression on conduit connections.
 - 3. Steel.
- D. Colors (factory finished):
 - 1. Red – Fire Alarm Systems
 - 2. Green – Emergency power systems.
 - 3. Purple - Security
 - 4. Blue - Telecommunications
 - 5. Standard Silver (no special finish) - Normal power systems

2.3 POLYVINYL CHLORIDE CONDUIT (PVC)

- A. Standard lengths and sizes.
- B. Minimum size ½“, with the exception that the minimum size conduit for underground site lighting circuits shall be 1”.
- C. Schedule 40, heavy wall rigid plastic (PVC) conduit manufactured to NEMA TC-2 standards, UL listed and as required by NEC. Sunlight resistant.
- D. Connectors and Couplings
 - 1. To match conduit.
- E. PVC conduit is NOT allowed to be run in any area that is in direct sunlight.

2.4 PVC COATED RIGID METAL CONDUIT

- A. Per NEMA Standards Publication No. RN 1 – 1980 and ANSI C80.1.

- B. Rigid steel galvanized conduit with PVC coating.
- C. Full weight 40 mil thick PVC coating, bonding to galvanized metal shall be stronger than plastic tensile strength.
- D. Minimum conduit diameter shall be ½ inch.
- E. Connectors and Couplings
 - 1. Full weight 40 mil PVC jacket.
 - 2. PVC gasketed for mating surfaces.
 - 3. Same as for rigid conduit.

2.5 FIBERGLASS CONDUIT

- A. Per UL 1684, rigid conduit and associated condulets and fittings shall be carbon black reinforced thermosetting resin suitable for above ground installation.
- B. Minimum conduit size shall be ¾ inch.
- C. Connectors and Couplings
 - 1. To match conduit.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Galvanized spiral strip flexible steel.
- B. Standard conduit sizes.
- C. Heavy wall sunlight resistant PVC jacket.
- D. Minimum size ½ inch.
- E. Connectors and Couplings
 - 1. Liquid-tight.
 - 2. Suitable for grounding.
 - 3. Suitable for wet locations.
 - 4. Tapered threaded hub.
 - 5. Non-metallic materials.

2.7 FLEXIBLE METAL CONDUIT

- A. Galvanized spiral strip flexible steel.
- B. Standard conduit sizes.
- C. Minimum size 1/2" with the exception that 3/8" diameter may be used to serve individual lighting fixtures installed in a suspended accessible ceiling system.
- D. Connectors and Couplings
 - 1. Threaded.
 - 2. Grounding type.
 - 3. Insulated throat.
 - 4. Two screw clamp type with locknuts.
 - 5. Externally secured.

2.8 SURFACE METAL RACEWAYS

- A. Raceways shall be two piece. Front cover shall be removable to provide access to wiring compartment.
- B. Raceways shall be galvanized steel.
- C. Raceways shall be provided with multiple knockouts and screw holes along back channel.
- D. All additional accessories required for a complete installation shall be provided.
- E. Raceways shall be ivory.
- F. Raceway Types
 - 1. Wiremold 500 Series minimum, or approved equal, to feed individual power and/or telecommunications wiring devices.
 - 2. Wiremold 4000 Series or approved equal: Shall not be less than 4-3/4" x 1-3/4" in size. Where plans call for telecommunications and power wiring to be run in the same raceway, the raceway shall be provided with a metal barrier. 4000 raceway shall be used wherever the multi- receptacle assembly symbol is shown on the floor plans.

2.9 EXPANSION FITTINGS

- A. Expansion fittings: Copper bonding jumper, Crouse-Hinds Type XJ.
- B. Expansion/deflection fittings: Copper bonding jumper, Crouse-Hinds Type XD.

2.10 CONDUIT BODIES

- A. Galvanized or cadmium plated.
- B. Threaded hubs.
- C. Removeable cover with gasket.
- D. Corrosion-resistant screws.

2.11 SEALS

- A. Wall entrance seals: Link seal type as manufactured by Thunderline Corporation.

2.12 INTERIOR WALL OUTLET BOXES – FLUSH MOUNTED

- A. Stud wall construction. Stamped steel, four-inch square, 2-1/8" deep, with square corners. Provide with raised device rings, height as required for wall finish thickness. Mounting accessories as required. Larger width boxes as required for ganging requirements indicated on plans.
- B. Masonry wall construction. Stamped steel. Face of box flush with wall, 3-1/2" deep box minimum. Width as required for ganging requirements shown on plans.

2.13 INTERIOR WALL OUTLET BOXES – SURFACE MOUNTED – DRY LOCATION

- A. In public areas: Cast malleable aluminum with threaded conduit hubs. Two inches deep minimum. Internal mounting ears. Boxes shall be coated with electroplated zinc, a dichromate coating and an aluminum polymer enamel finish.
- B. Other areas: Stamped steel, four-inch square, 2-1/8" deep, with round corners. Provide rounded corner raised box covers with openings as required for devices being installed.

2.14 INTERIOR WALL OUTLET BOXES-SURFACE MOUNTED-DAMP OR WET LOCATION

- A. Cast malleable aluminum with threaded conduit hubs. Two inches deep minimum. Internal mounting ears. Boxes shall be coated with electroplated zinc, a dichromate coating and an aluminum polymer

enamel finish.

2.15 EXTERIOR WALL OUTLET BOXES - SURFACE MOUNTED

- A. Single or two gang as indicated on the plans. Cast malleable iron with threaded conduit hubs. Two inches deep minimum. Internal mounting ears. Boxes shall be coated with electroplated zinc, a dichromate coating and an aluminum polymer enamel finish.

2.16 CEILING BOXES - FLUSH MOUNTED - FOR SURFACE AND PENDANT LIGHT FIXTURES

- A. Dropped ceiling construction. Stamped steel four-inch octagon box set flush with finished surface, complete with 3/8" fixture stud.
- B. Cast in place concrete construction. Stamped steel four-inch octagonal, galvanized concrete boxes, having a minimum depth of 3", complete with 3/8" fixture stud.

2.17 ELECTRICAL BOXES IN CORROSIVE LOCATIONS

- A. PVC coated cast steel boxes compatible with conduit system installed. Coating shall cover both interior and exterior surfaces. See floor plans for identification of corrosive areas.

2.18 SPECIAL BOXES

- A. Provide special boxes fabricated by the manufacturer of fixtures and other devices where standard outlets are not applicable.

2.19 INTERIOR GENERAL PURPOSE JUNCTION AND PULL BOXES

- A. Fabricated from code gauge galvanized steel with covers held in place by corrosion resistant machine screws.
- B. Size as required by code for number of conduits and conductors entering and leaving box.
- C. Provide with welded seams, where applicable and equip with corrosion-resistant nuts, bolts, screws and washer.

2.20 ACCESS PANELS

- A. Furnish type necessary for the particular wall or ceiling construction in which they occur.
- B. Panels to be completed with screwdriver cam locking device.

2.21 EXTERIOR JUNCTION BOXES

- A. Stainless steel or cadmium plated malleable iron cast type with threaded hubs, cast cover and neoprene gasket. Provide NEMA 4X rating.

2.22 BETWEEN STUD BOX SUPPORT BRACKETS

- A. Stamped and fabricated steel bracket designed to support 4" or 4-11/16" electrical boxes between wall studs.
- B. Manufactured by Erico, RBS series or equivalent.

2.23 EXTERIOR PULL BOXES

- A. Pull boxes shall be constructed of a composite material as shown on the plans. The composite boxes shall be constructed of polymer concrete and reinforced by a heavy-weave fiberglass as manufactured by Quazite or approved equal. The pull boxes shall be rated for 15,000 lbs. over a 10" x 10" area at a temperature of -50°F and be UL listed.
- B. The box shall be furnished with a cover having a skid resistant surface with a minimum coefficient of friction of .5 and concrete gray color. The cover fasteners shall be stainless steel captive 3/8-inch hex head bolts with stainless steel inserts. The cover for the pull box shall have an "ELECTRIC", "LIGHTING" or "COMMUNICATIONS" logo corresponding with system, unless otherwise noted on the plans.

PART 3 – EXECUTION

3.1 GENERAL

- A. Interior conduits for wiring systems rated 0 to 600 volts shall be electrical metallic tubing (EMT). Exceptions to the requirements stated above are as follows.
 - 1. Poured concrete: PVC.
 - 2. Motor connection: Flexible conduit of appropriate type.
 - 3. Hazardous and corrosive locations: PVC coated Rigid Metal Conduit.
 - 4. Corrosive locations only: PVC.
 - 5. Damp/wet areas (i.e. crawl spaces): PVC.
 - 6. Areas subject to damage shall (i.e. loading docks): GRC.
 - 7. Where otherwise stated in these specifications or on the floor plans.

- B. Exterior underground conduits, service entrance conduits and conduits embedded in concrete lighting fixture pole bases shall be heavy wall schedule 40 PVC except as follows:
 - 1. Underground conduit runs which enter or exit the building envelope shall utilize galvanized rigid conduit from the point of penetration of the building envelope and the next 5' portion of the run in direct contact with the earth. Where conduits pass through poured concrete walls the EC shall install sleeves prior to the walls being poured.
- C. Conduits below the building slab shall be heavy wall schedule 40 PVC.
 - 1. When PVC conduit is stubbed-up above the slab, it shall only extend between 4"-6" above the top of the slab and be transitioned to the appropriate conduit allowed.
- D. Conduits encased in concrete as part of an underground electrical duct package shall be Schedule 40 HW PVC except that conduits shall be PVC coated rigid galvanized steel within 5' of the building envelope or for bends greater than 30 degrees.

3.2 UNDERGROUND AND EXTERIOR CONDUIT

- A. Exterior underground conduit shall be buried at a depth of not less than 24 in., nor more than 36" below grade or pavement.
- B. Provide conduits or ducts terminating below grade with means to prevent entry of dirt or moisture.
- C. Underground conduits shall slope 1/8" per foot for proper drainage. Conduits shall drain toward manholes and junction boxes, not the electrical equipment.
- D. Conduit that rises from below grade to an exposed above grade termination shall have conduit from the bend below grade (including bend) to termination point constructed with rigid steel conduit or fiberglass conduit. An expansion fitting shall be installed if the conduit above grade is 24" or longer.

3.3 PROCEDURES AND PRACTICES

- A. All conduits shall be routed concealed in finished spaces and shall not be visible at any point within the finished space or from the building's exterior. This requirement also applies to new conduits installed in existing construction. Exposed raceway may be used only where physically impossible to route concealed in construction. In such cases where exposed raceway is allowed it shall be surface type in public

areas as dictated by the wiring quantities. In each case the specific raceway type and routing shall be submitted to the Architect for approval. Where allowed, the general installation requirements are as follows:

1. Raceways shall be routed horizontally along the corners of walls and ceilings, directly above edges of base molding at floors, or along the tops of window and door frames.
 2. Raceways shall be routed vertically along corners of adjacent walls and along the edges of window and door frames.
 3. Raceways shall not be routed down or across open wall surfaces except in portions of runs not exceeding 12" in length.
 4. Raceways shall be painted to match wall finishes. EC is responsible for painting of all raceways.
 5. Fittings and boxes used with raceways shall be specifically designed and approved for use with the raceways.
- B. Cut joints shall be square, reamed smooth and drawn up tight.
- C. Keep conduit plugged, clean and dry during construction.
- D. Cap spare conduits.
- E. Provide riser clamps around all conduits 1-1/4" or larger that are routed between floors. Provide conductor support in vertical risers greater than 20' as appropriate.
- F. Provide a watertight conduit system where installed in wet locations such as underground, or where embedded in concrete.
- G. Route conduit runs above suspended acoustical ceilings so as not to interfere with ceiling tile removal. Conduit supports shall be attached to building structural elements. Conduits shall not be supported by or attached to the suspension systems for dropped ceiling systems unless specifically detailed on the drawings.
- H. Conduits may be routed exposed in mechanical equipment rooms and utility rooms.
- I. Route all conduits (including conduits routed above ceilings) parallel to or at right angles with lines of the building construction and structural members except conduit runs routed concealed in pour-in-place concrete floor slabs may be run in direct line from source load.

- J. Make bends and offsets without kinking or destroying smooth bore of conduit. Arrange bends and offsets in parallel conduits to present a neat symmetrical appearance.
- K. Secure conduits in place with malleable corrosion-proof alloy straps or hangers. Conduit straps used in corrosive areas shall be PVC coated.
- L. The use of perforated strapping as a conduit hanging method is not approved.
- M. Conduit runs that extend through areas of different temperature or atmospheric conditions shall be sealed, drained and installed in a manner that will prevent drainage of condensed or entrapped moisture into cabinets and equipment enclosures.
- N. Route conduits within poured concrete construction parallel to each other and spaced on center of at least three times conduit trade diameter with minimum two

(2) inches of concrete covering. Conduits over 1 ¼" may not be installed in slab without the approval of the Architect. Conduits embedded in a structural frame slab shall comply with applicable provisions of American Concrete Institute (ACI), Standard 318. Conduits used for feeders shall not be embedded in concrete floor slabs.
- O. In areas constructed of pre-cast concrete, run conduits in insulation space or in floor topping slabs without crossing other conduits, using ¾" maximum conduit size.
- P. Install flexible steel conduit whips from an independent junction box mounted above ceiling to recessed ceiling mounted lighting fixtures. Allow for positioning of equipment to tile increments.
- Q. Connections to Motors and Equipment Subject to Vibration:
 - 1. Flexible steel conduit not over three (3) feet long for connection to motorized equipment.
 - 2. Liquid-tight flexible conduit not over three (3) feet long where exposed to moisture, dirt, fumes, oil, corrosive atmosphere with connectors to assure a liquid-tight, permanently grounded connection. Locate so it is least subject to physical abuse. Corrosive areas are identified on the floor plans.
 - 3. Use double locknuts and insulated bushings with threads fully engaged.

- R. Install bushings with ground lugs and integral plastic linings at equipment with open bottom conduit entrances.
- S. Install conduit expansion fittings where conduits cross expansion joints.
- T. Install No. 12 pull wire in empty conduit.
- U. All wiring in raceways shall be provided with a separate green grounding conductor.
- V. All conduits that terminate in free air (no connection to equipment or box) shall be provided with an insulated bushing.
- W. All wiring in walls shall have a raceway within the wall with an enclosed outlet box regardless if the remaining portion of the particular system is installed in raceway or free-air.

3.4 FIRE STOPS AND PENETRATION SEALS

- A. All penetrations through fire rated floors and walls due to the electrical installation shall be sealed with CHASE-FOAM PR-855 Fire Resistant Foam Sealant, to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after a fire. The fire rating of the penetration seal shall be at least that of the floor or wall into which it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. Equivalent foam sealant manufactured by Dow Corning approved.
- B. The sealant shall remain soft and pliable to allow for the removal and/or addition of cables without the necessity of drilling holes. It shall adhere to itself perfectly to allow any all repairs to be made with the same material. It shall permit the vibration, expansion and/or contraction of anything going through the penetration without the seal cracking or crumbling.
- C. When damming materials are to be left in place after the seal is complete then all such materials shall be non-flammable.
- D. When sealant is injected into a penetration, the foam shall expand to surround all the items within the penetration and maintain pressure against the walls of the penetration. The foam shall cure within five minutes and be fire resistant at that time. No heat shall be required to further expand the foam to block the passage of fire and smoke or water.
- E. All wall or floor penetrations openings shall be as small as possible.
- F. The foam sealant shall meet all fire test and hose stream test

requirements of ASTM E119-73 and shall be UL Classified as a Wall Opening Protective Device.

- G. All penetrations through non-fire rated walls shall be sealed with an appropriate sealant.

3.5 CUTTING AND PATCHING

- A. Provisions for opening, holes and clearances through walls, floors, ceilings and partitions shall be made in advance of construction.
- B. Provide cutting, patching and painting necessary for the installation of electrical systems.
- C. Where conduits need to penetrate concrete or masonry construction below grade, the EC shall install PVC sleeves with integral waterstop, one (1) inch larger in diameter than the conduit being installed. Install sleeves before walls and/or slabs are poured or constructed.
- D. Where conduits need to penetrate concrete or masonry construction above grade, the EC shall install 22 gauge galvanized steel pipe sleeves, one (1) inch larger in diameter than the conduit being installed. Sleeves shall extend 2" above and below the floor slab penetrated. Install sleeves before walls and/or slabs are poured or constructed.
- E. The Electrical Contractor shall prepare drawings indicating size and location of all anticipated floor sleeves for the installation of electrical conduits. Such drawings shall be made available to the General Contractor 10 days prior to any scheduled concrete work.

3.6 RESTRICTIONS

- A. Conduits routed parallel to steam lines, hot water pipes, high temperature piping or ducts shall be routed at least 12" from such and shall be a minimum of 12" clear when crossing same.
- B. Do not route conduit over boiler, incinerator or other high temperature equipment.
- C. Where conduits must cross or follow the same path as water, steam or other fluid piping, run electrical conduits above such piping wherever possible.

3.7 ADJUSTMENT AND CLEANING

- A. Restore damaged areas on PVC jacketed, rigid conduit with spray type touch-up coating compound or as directed by manufacturer.

- B. Pull cleaning plug through conduits to clear of dirt, oil and moisture.

3.8 CONDUIT SYSTEMS

- A. Where raceways are required, separate raceway systems shall be provided for each wiring system as follows:
 - 1. 208 volt normal power wiring systems.
 - 2. 208 volt code required emergency power wiring systems.
 - 3. Voice/data communications raceway systems.

3.9 CONDUIT FITTINGS

- A. Install electrical fittings in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that fittings serve intended purposes.
- B. Rigidly secure connectors at cabinets and boxes with galvanized lock nut and bushing.
- C. Seal conduits that run through different temperature or atmospheric conditions to prevent condensation or moisture from entering electrical equipment and devices.
- D. Install wall entrance seal where conduits or direct burial conductors pass through foundation walls below grade.
- E. Install conduit expansion fittings complete with bonding jumper in following locations:
 - 1. Conduit runs which cross a structural expansion joint.
 - 2. Conduit runs where movement perpendicular to axis of conduit may be encountered.
- F. Locate conduit bodies so as to assure accessibility of electrical wiring.
- G. Install fittings designed for use with flexible liquid-tight conduit to ensure continuity of ground throughout the fittings and conduit, and prevent entrance of moisture.
- H. Exposed PVC runs, subject to temperature changes of more than 20 degrees, and longer than 10 feet shall have an expansion fitting (long or short type as appropriate) installed in middle of run.

3.10 BOX INSTALLATION

- A. Install electrical boxes as indicated in compliance with NEC requirements, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that the boxes serve the intended purposes.
- B. Seal conduit at entrance to weatherproof boxes for interior and exterior locations exposed to weather or moisture.
- C. Install knockout closures to cap unused knockout holes where blanks have been removed.
- D. Locate boxes so as to assure accessibility of electrical wiring. Relocate boxes rendered inaccessible by the installation of work by other trades.
- E. Secure boxes rigidly to the substrate upon which they are being mounted or solidly embed boxes in concrete or masonry. Do not support from conduit.
- F. Set boxes, in concealed conduit runs, flush with wall surfaces, with or without covers, as required.
- G. Do not install boxes back to back or through wall. Offset outlet boxes on opposite sides of wall a minimum of 12 inches.
- H. Set outlet boxes parallel to construction, securely mounted and adjusted to set true and flush with the finished surface.
- I. Do not burn conduit holes, use knock-out punches or hole saws.
- J. Use "no-bolt" studs where specifically detailed on the drawings.
- K. Boxes shall be sized per code to accommodate the number and size of conduit entrances to the box and to accommodate the number of conductors, splices, fittings, etc., within the box. Do not use box extensions to create additional volume to meet NEC requirements for the number of conductors contained in a box.

3.11 EXPOSED OUTLET AND JUNCTION BOXES

- A. Install non-rusting metal weatherproof cover on recessed junction box in new walls or non-rusting surface mounted metal junction boxes on existing walls outdoors and in any area where drawings show weatherproof (WP) or weatherproof-while-in-use (WPIU) wiring devices. Provide non-rusting metal WPIU covers anywhere required by code, even if not indicated on plans.

3.12 INTERIOR OUTLET BOX ACCESSORIES

- A. Provide outlet box accessories as required for each installation, such as mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

3.13 LIGHTING FIXTURE OUTLET BOXES

- A. Securely mount with approved type bar hangers spanning structural members to support weight of fixture.
- B. Do not support from conduit.
- C. Equip with 3/8" fixture studs and tapped fixture ears for surface mounted or pendant mounted lighting fixtures. Fixture studs shall be provided for mounting of all lighting fixtures exceeding 25 lbs in weight. Fixture studs shall be attached through knockouts at the top of the box.
- D. Provide additional attachments from structure for outlet boxes supporting lighting fixtures weighting in excess of 25 lbs.

3.14 OUTLET BOX LOCATIONS

- A. Locate flush mounted wall boxes in corner of nearest brick or block to keep cutting to a minimum.
- B. Location of outlets and equipment as shown on drawings is approximate, and exact location is to be verified and shall be determined by:
 - 1. Construction or code requirements
 - 2. Conflict with equipment of other trades.
 - 3. Equipment manufacturer's drawings.
- C. Where receptacles and communication outlets are shown grouped next to each other on the drawings, the boxes for these outlets shall be mounted next to each other and shall not be located according to stud spacings. The Contractor shall utilize between stud box supports to assist in mounting boxes proximal to one another on a consistent spacing between wall studs.
- D. Minor modification in the location of outlets and equipment is considered incidental up to a distance of 10 feet, provided the change in location is requested prior to rough-in. Outlets shall not have their locations significantly altered from that shown on the plans unless approved by the engineer – relocations necessary to relocate and install in the intended position due to unapproved relocations shall be at the sole cost

to the electrical contractor.

- E. Mounting heights for devices and equipment to be measured from finished floor to center line of device.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS & DUCTBANKS

PART 1 GENERAL

1.1 Provide underground duct banks for power and lighting feeders; instrumentation and control systems as shown or as specified herein; from point of service switchgear or equipment to the point of distribution or equipment served.

1.2 SUBMITTALS

A. Submit shop drawings or cut sheets on

1. Conduit
2. Fittings
3. Conduit Separators
4. PVC solvent
5. Precast concrete manholes
6. Composite handholes
7. Cable lubricants

1.3 DESCRIPTION OF ASSEMBLY

A. Underground duct banks shall be multiple individual conduits encased in reinforced concrete as indicated on the drawings. Conduits within building or structural foundations and protected by a concrete slab above them do not require encasement (except provide encasement or flowable fill under electrical and pump room slabs). The conduit shall be of plastic (PVC sch 40 for concrete encasement and Sch80 without concrete encasement), unless indicated or specified otherwise. The conduit used shall not be smaller than 4 inches in diameter, inside, unless otherwise noted. The concrete encasement surrounding the duct bank shall be rectangular in cross-section, having a minimum concrete thickness of three inches around all conduits. All concrete encased duct banks shall be steel reinforced as detailed. Power distribution conduits shall be separated by a minimum dimension of four inches and not less than 7.5" center to center. Power conduits shall be separated from low voltage instrumentation & control conduits by a minimum dimension of twenty four inches.

B. The concrete work shall conform to Section on "Concrete". The top of the concrete envelope shall be not less than 24 inches below grade unless otherwise indicated. Concrete shall be installed in a continuous pour to eliminate joints in the duct run. The duct bank sides shall be formed in place using suitable concrete form work or corrugated metal forms. Open trench pours will not be allowed.

- C. Plastic conduit, fittings and joints shall not have been stored in the sun or weather, in any excessively heated space, or unevenly supported during storage. Use and installation shall be in accordance with the National Electrical Code requirements for the installation of non-metallic rigid conduit. Plastic conduit shall be protected against the direct rays of the sun prior to installation. Conduit shall be PVC schedule 40 manufactured by Carlon, Queen City Plastics, or approved substitution. Conduit shall be U.L. listed and conform to NEMA Standards for schedule 40 PVC conduit.
- D. Trenches for duct banks shall be completely dry before setting conduits or pouring concrete. Provide well pointing as required if necessary to keep trench dry.
- E. Wires and cables in manhole/handhole shall be placed on cable racks. Manhole/handhole shall be cleaned of all loose materials, dirt and debris immediately after completion of new work and shall be in a clean condition when project is completed. Cable racks shall be stainless steel or non metallic with stainless steel hardware, cable racks shall be complete with insulators. Racks shall be Underground Devices or approved substitution.
- F. Back filling of trenches shall be in layers not more than 8 inches deep, and shall be thoroughly tamped. The first layer shall be earth or sand, free from particles that would be retained on a 1/4 inch sieve. The succeeding layers shall be excavated material having stones no larger than would pass through a 4-inch ring. The back fill shall be level with adjacent surface, except that in sodded or paved areas, a space equal to the thickness of the sod or paving shall be left.
- G. The surface disturbed during the installation of duct shall be restored to its original elevation and condition if not refinished in connection with site work.
- H. All unused conduit openings shall be plugged or capped with a suitable device designed for the purpose; caulking compound shall not be used for plugging conduit openings.
- I. One No. 2 bare solid tinned copper counterpoise shall be run above all duct banks and shall be run into all manholes/handholes and grounded to 5/8" X 20' driven ground rods. Counterpoise shall run into buildings and be grounded at each structures service ground.
- J. All conduits entering a building or structure shall be sealed with duct seal.

PART 2 PRODUCTS

2.1 DUCT BANK STRUCTURES

- A. Precast Concrete Construction: Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes and pullboxes.
1. General: Concrete for precast work shall have an ultimate 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated precast monolithically and placed as a unit, or structures may be assembled sections, design and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.
 2. Construction: Structure top, bottom and wall shall be of a uniform thickness of not less than 4 inches. Quantity, size, and location of duct bank entrance windows shall be as required, and cast completely open by the precaster. Size of windows shall exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows shall be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. The minimum concrete cover for reinforcing steel shall be 2 inches. Provide drain sumps for precast structures a minimum of 12 inches in diameter and 6 inches deep.
 3. Joints: Provide tongue-and-groove or shiplap joints on mating edges of precast components. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to AASHTO M198, Type-
- B. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.
- C. Precast Concrete manholes and pullboxes (handholes): ASTM C 478. Precast units shall be the product of a manufacturer regularly engaged in

the manufacture of precast concrete manholes and pullboxes. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Metal Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable.

- D. Metal Frames and Covers: Shall be made of cast iron. Covers shall weight a minimum 100lb. Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Covers shall have raised letters of identification as indicated on the drawings. Covers shall have an approved antislip surface. Covers shall be rated AASHTO H20.
- E. Pulling-In Irons: Shall be steel bars bent cast in the walls and floors. In the floor they shall be centered under the cover and in the wall they shall be not less than 6 inches above or below, and opposite the conduits entering the manhole or pullbox. Pulling- in irons shall project into the box approximately 4 inches. Iron shall be hot-dipped galvanized after fabrication.
- F. Cable Racks: Rack arms and insulators, shall be sufficient to accommodate the cables. Racks in manhole and pullbox shall be spaced not more than 2 feet apart, and each box wall shall be provided with a minimum of two racks. The wall bracket shall be stainless steel or fiberglass. Slots for mounting cable rack arms shall be spaced at 8-inch intervals. The cable rack arms shall be of stainless steel or fiberglass and shall be of removable type. Insulators shall be dry-process glazed porcelain. All metal fasteners and hardware portion of racks shall be stainless steel.
- G. Grounding in manholes and pullboxes: Provide No. 6 AWG bare copper grounding pigtailed on walls of each manhole and pullbox. The pigtailed shall be exothermically welded to the reinforcing bars and shall extend at least 8 inches into box. Two pigtailed shall be provided in each box.
- H. Pull Wire: Plastic rope having a minimum tensile strength of 200 pounds in each empty duct. Leave a minimum of 24 inches of slack at each end of the pull wires.
- I. Composite Handholes: Only where composite handholes are indicated on

the drawings, use handholes, covers and boxes of polymer concrete as manufactured by Quazite Corporation. The material shall consist of aggregate bound together with a polyester resin and reinforced with continuous woven glass strands. The covers and boxes shall be designed to be installed flush to grade with cover fitting flush to the box and shall be capable of withstanding normal shipping and installation process without chipping, cracking or structural damage. All boxes shall be manufactured with the use of male/female molds to ensure a consistent wall thickness and structural strength and shall be stackable or extra depth. The boxes and covers shall have dimensions as indicated and shall be concrete gray in color. The cover logo shall be recessed into the cover and shall read INSTRUMENTATION or ELECTRIC as indicated. The composite covers shall be designed for a static vertical load of 8,000 pounds and shall be tested, in the box, to a static load of 12,000 pounds (1.5 safety factor). The test load shall be distributed over a 10 inch by 10 inch by 1 inch thick distribution plate located at the center of the cover. The maximum deflection at a load of 8,000 pounds shall not exceed 0.50 inches. The covers shall be skid resistant and have a minimum coefficient of friction of 0.50 on the top surface for the life of the cover. Coatings will not be provided. The permanent deflection of any surface shall not exceed 10% of the maximum allowable test load deflection. The lockdown mechanism shall be capable of withstanding a minimum torque of 30 foot-pounds. All inserts and fasteners shall be of stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION: Conform to NFPA 70 and ANSI C2.

- A. The top of the conduit shall be not less than 24 inches below grade, for low voltage conduits and 48 inches for high voltage ducts. Run conduit in straight lines except where a change of direction is necessary. Provide not less than 3 inches clearance from the conduit to each side of the trench. A minimum clearance of 2 1/2 inches shall be provided between adjacent conduits. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve.
- B. Precast manhole and pullbox Installation: Commercial precast assembly shall be set on 6 inches of level, 90 percent compacted granular fill, 3/4-inch to 1-inch size, extending 12 inches beyond the manhole or pullbox on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator.
- C. Buried Warning and Identification Tape: Metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape

on rolls, 3-inch- minimum width, color coded as specified below for the intended utility and warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Yellow or red: Electric power

Orange: Instrumentation and Control

- D. Conduit Placement: Duct lines shall have a continuous slope downward toward manholes/handholes and away from buildings with a pitch of not less than 3 inches in 100 feet. Except at conduit risers, accomplish changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet. Manufactured bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter and larger.
- E. Termination and Cleaning of Conduit: Terminate conduits in end-bells where duct lines enter manholes and pullboxes. Separators shall be of precast concrete, high impact polystyrene, steel, or a combination of these. Stagger conduit joints by rows and layers to provide a duct line having the maximum strength. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand, and dirt with suitable conduit plugs. As each section of a duct line is completed, draw a non-flexible testing mandrel not less than 12 inches long with a diameter 1/4 inch less than inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush having the same diameter of the duct through the duct, until duct is clear of particles of earth, sand, and gravel; then immediately install end plugs.
- F. Conduit Protection at Concrete Penetrations: Conduits which penetrate concrete (slabs, pavement, and walls) shall be galvanized rigid steel; protected by a PVC sheath at the penetration; PVC sheath shall be 40-mils thick conforming to NEMA RN 1, and shall extend from at least 2 inches below the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches above concrete).
- G. Cable Pulling: Pull Cables down grade with the feed-in point at the manhole or pullbox or point of the highest elevation. Use flexible cable feeds to convey cables through box opening and into duct runs. Accumulate cable slack at each box where space permits by training cable around the interior to form one complete loop. Maintain minimum allowable bending radii in forming such loops.

- H. Cable Lubricants: Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables. Cable lubricants shall be soapstone, graphite, or talc for rubber or plastic jacketed cables. Lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.
- I. Cable Pulling Tensions: Tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.
- J. Installation of Cables in manholes and pullboxes and Handholes: Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators at a maximum of 18 inches. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space opening for future cables, except as otherwise indicated for existing installations.
- K. FIREPROOFING OF CABLES IN MANHOLES: All wire and cables in manholes shall be fireproofed. Strips of fireproofing tape approximately 1/16 inch thick by 3 inches wide shall be wrapped tightly around each cable spirally in one-half lapped wrapping, or in two butt-jointed wrappings with the second wrapping covering the joints in the first. The tape shall be applied with the coated side toward the cable, and shall extend one inch into the ducts. To prevent unraveling, the fireproofing (Arc-proofing) tape shall be random wrapped with tape conforming to type FGT of specification MIL-I-15126. The fireproofing (arc proofing) tape shall consist of a flexible, conformable fabric having one side coated with a flame-retardant, flexible, polymeric coating and/or a chlorinated elastomer. The tape shall not be less than 0.050 inch thick, and shall weigh not less than 2.5 pounds per square yard. The tape shall be non-corrosive to cable sheath, shall be self-extinguishing, and shall not support combustion. The tape shall not deteriorate when subjected to oil, water, gases, saltwater, sewage and fungus. The tape shall have a tensile strength of not less than 40 pounds per inch width, and when tested under USA Standard L14.184 cut strip method. Provide certification the product retains 65 percent of its original tensile strength for the following tests for 168 hours for each requirement;
1. Immersion in distilled water,
 2. Immersion in 3 percent salt water,
 3. Exposure to ultra-violet light (30-watt germicidal lamp),
 4. Exposure to sunlight (Type S-1 sun lamp), and exposure to concentrated sewage.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, connection, and testing of wiring devices.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

1.3 QUALITY ASSURANCE

Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

- 1. Shop Drawings:
 - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
- 2. Manuals:

- a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
 - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
- a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
 - b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

National Electrical Manufacturers Association (NEMA):

WD 1-99(R2015).....General Color Requirements for Wiring Devices

WD 6-16Wiring Devices – Dimensional Specifications

National Fire Protection Association (NFPA):

70-17.....National Electrical Code (NEC)

99-18.....Health Care Facilities

Underwriter’s Laboratories, Inc. (UL):

5-16.....Surface Metal Raceways and Fittings

20-10.....General-Use Snap Switches

231-16.....Power Outlets

467-13.....Grounding and Bonding Equipment

498-17.....Attachment Plugs and Receptacles

943-16.....Ground-Fault Circuit-Interruption

1449-14.....Surge Protective Devices

1472-15.....Solid State Dimming Controls

PART 2 PRODUCTS

2.1 RECEPTACLES

- A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.

1. Mounting straps shall be nickel plated brass, brass, nickel plated steel or galvanize steel with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
 2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.
- B. Duplex Receptacles: single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation.
1. Bodies shall be brown in color unless specified otherwise.
 2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The lower receptacle shall be unswitched.
 3. Duplex Receptacles on Emergency Circuit:
 - a. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.
 4. Ground Fault Current Interrupter (GFCI) Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring. GFCI receptacles shall be self-test receptacles in accordance with UL 943.
 - a. Ground fault interrupter shall consist of a differential current transformer, self-test, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or – 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
 - b. Self-test function shall be automatically initiated within 5 seconds after power is activated to the receptacles. Self-test function shall be periodically and automatically performed every 3 hours or less.
 - c. End-of-life indicator light shall be a persistent flashing or blinking light to indicate that the GFCI receptacle is no longer in service.
 5. Tamper-Resistant Duplex Receptacles:
 - a. Bodies shall be gray in color.

- 1) Shall permit current to flow only while a standard plug is in the proper position in the receptacle.
 - 2) Screws exposed while the wall plates are in place shall be the tamperproof type.
- C. Receptacles - 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.
- D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.
- E. Surge Protective (TVSS) Receptacles shall have integral surge suppression in line to ground, line to neutral, and neutral to ground modes.
1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 Volts, and minimum single transient pulse energy dissipation of 210 Joules.
 2. Active TVSS Indication: LED, visible in face of device to indicate device is active or no longer in service.

2.2 TOGGLE SWITCHES

- A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory in color unless otherwise specified or shown on the drawings.
1. Switches installed in hazardous areas shall be explosion-proof type in accordance with the NEC and as shown on the drawings.
 2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
 3. Switches shall be rated 20 amperes at 120-277 Volts AC.

2.3 MANUAL DIMMING CONTROL

- A. Electronic full-wave manual slide dimmer with on/off switch and audible frequency and EMI/RFI suppression filters.
- B. Manual dimming controls shall be fully compatible with fluorescent electronic dimming ballasts and approved by the ballast manufacturer, shall operate over full

specified dimming range, and shall not degrade the performance or rated life of the electronic dimming ballast and lamp.

- C. Manual dimming controls shall be fully compatible with LED dimming driver and be approved by the driver manufacturer, shall operate over full specified dimming range, and shall not degrade the performance or rated life of the electronic dimming driver and lamp. Provide single-pole, three-way or four-way, as shown on the drawings.
- D. Manual dimming control and faceplates shall be //ivory// // // in color unless otherwise specified.

2.4 WALL PLATES

- A. Wall plates for switches and receptacles shall be type 302 stainless steel or smooth nylon. Oversize plates are not acceptable.
- B. Nylon color shall be brown unless otherwise specified.
- C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- D. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.
- E. Duplex Receptacles on Emergency Circuit: Wall plates shall be red nylon with the word "EMERGENCY" engraved in 6 mm (1/4 inch) white letters.

2.5 SURFACE MULTIPLE-OUTLET ASSEMBLIES

- A. Shall have the following features:
 - 1. Enclosures:
 - a. Thickness of steel shall be not less than 1 mm (0.040 inch) for base and cover. Nominal dimensions shall be 40 mm x 70 mm (1-1/2 inches by 2-3/4 inches) with inside cross sectional area not less than 2250 square mm (3-1/2 square inches). The enclosures shall be thoroughly cleaned, phosphatized, and painted at the factory with primer and the manufacturer's standard baked enamel finish.
 - 2. Receptacles shall be duplex. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.
 - 3. Unless otherwise shown on drawings, receptacle spacing shall be 600 mm (24 inches) on centers.

4. Conductors shall be as specified in Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE.
5. Installation fittings shall be the manufacturer's standard bends, offsets, device brackets, inside couplings, wire clips, elbows, and other components as required for a complete system.
6. Bond the assemblies to the branch circuit conduit system.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC and as shown as on the drawings.
- B. Install wiring devices after wall construction and painting is complete.
- C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.
- D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.
- E. Provide barriers in multi-gang outlet boxes to comply with the NEC.
- F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.
- G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.
- H. Install wall switches 1.2 M (48 inches) above floor, with the toggle OFF position down.
- I. Install wall dimmers 1.2 M (48 inches) above floor.
- J. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.

- K. Install horizontally mounted receptacles with the ground pin to the right.
- L. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.
- M. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Perform manufacturer's required field checks in accordance with the manufacturer's recommendations, and the latest NFPA 99. In addition, include the following:
 - 1. Visual Inspection and Tests:
 - a. Inspect physical and electrical conditions.
 - b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.
 - c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
 - d. Test GFCI receptacles.
 - 2. Receptacle testing in the Patient Care Spaces, such as retention force of the grounding blade of each receptacle, shall comply with the latest NFPA 99.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 26 29 13

CONTROL PANELS (GENERAL)

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish all labor, equipment, and materials for control panels as indicated on the drawings and specified herein. The panel supplier shall be a UL listed panel shop and all panels shall be UL-508 certified and labeled.
- B. Control panel equipment shall be coordinated to provide all the specified control as indicate in the elementary diagrams or specified herein.
- C. The Contractor shall be responsible for coordinating and interfacing with equipment and instrumentation supplied under other sections of the Contract Documents that are an integral part of the plant control systems. This interfacing shall be incorporated in the detailed systems drawings and data sections to be submitted by the contractor prior to rough-in work.

1.2 SUBMITTALS

- A. The contractor shall submit to the Engineer for approval complete shop drawings, wiring diagrams, data, and operation and maintenance manuals of all equipment to be furnished under this section.
- B. Coordination and Shop Drawings: Prepare and submit coordination drawings for installation of products and materials fabricated. Coordination and shop drawings shall be prepared using a computer aided drafting system compatible with Autodesk Autocad version 2014 or greater. Coordination and shop drawings shall be submitted on hard copy and electronic CD-Rom (dwg) format.
 - 1. Submit component interconnect drawings showing the interconnecting wiring between each component including equipment supplied under other sections requiring interfacing with the control system. Diagrams shall show all component and panel terminal board identification numbers, and external wire and cable numbers. Note, this diagram shall include all intermediate terminations between field elements and panels (e.g., terminal junction boxes, pull boxes, etc.). Diagrams' device designations, and symbols shall be in accordance with NEMA ICS 1-101.
 - 2. Panel Wiring Diagrams: Elementary diagrams shall be similar to those diagrams shown in the drawings, but with the addition of all

auxiliary devices such as additional relays, alarms, fuses, lights, fans, heaters, etc.

3. Panel wiring diagrams shall identify wire numbers and types, terminal numbers, tag numbers and PLC I/O identification (address) numbers. Wiring diagrams shall show all circuits individually; no common diagrams shall be allowed.
4. Submit arrangement and construction drawings for consoles, control panels, and for other special enclosed assemblies for field installation. Include dimensions, identification of all components, preparation and finish data, nameplates, enough other details to define the style and overall appearance of the assembly and a finish treatment. Drawings shall show the location of all front panel mounted devices to scale, and shall include a panel legend and a bill of materials. The panel legend shall list and identify all front of panel devices by their assigned tag numbers, all nameplate inscriptions, service legends and annunciator inscriptions. The bill of materials shall list all devices mounted within the panel that are not listed in the panel legend, and shall include the tag number, description, manufacturer and complete model number for each device.
5. Submit installation, mounting, and anchoring details for all components.

C. Operation, Maintenance and Repair Manuals

1. Submit operation and maintenance manuals.

D. Panel Record Drawings

1. Provide one set of laminated approved panel record drawings inside each control panel.
2. Include one loose set of laminated approved panel record drawing inside of each control panel door data pocket.

1.3 CODES AND STANDARDS

- A. Equipment, materials, and workmanship shall comply with the latest revisions of the following codes and standards
1. Instrumentation: Instrument Society of America (ISA).
 2. National Electrical Code (NEC).
 3. Wiring: ISA S5.3 and S5.4, latest issue.

4. Control Panels and equipment: NEMA, UL and ANSI.
5. Control Logic: Joint Industrial Council (JIC).
6. UL508A and UL508A-SB

PART 2 - PRODUCTS

2.1 GENERAL

- A. Control panels shall be UL508A/SB compliant. Control panels with resident voltages greater than 120V shall be marked with a short circuit current rating (SCCR). The SCCR shall be equal to or more than the short circuit current available at the panel line terminals and in no case be less than 10,000A SCCR. The panel designer shall verify the available short circuit required.
- B. Unless specified otherwise, the electrical control equipment shall be mounted within a pad-lockable NEMA Type 4X wall mount for exterior installation locations and freestanding for interior installation locations, dead-front enclosure constructed of not less than 304 stainless steel powder coated white and shall be equipped with a 3-point latch with all hardware and exterior components construction of 300 series stainless steel (except control panels in air conditioned spaces and electrical room may be NEMA 1 painted steel). Provide data pocket. The enclosure shall be powder coated white. Bottom entry ONLY of cables shall be permitted. The enclosure shall be fitted with legs to allow conduit entry into the bottom of the enclosure. Flat bottom enclosures set on concrete pads with open window cutting of enclosure bottom for conduits is strictly prohibited. The enclosure shall be equipped with sunshields for exterior installation locations, an inner dead front door and shall incorporate a removable, aluminum or stainless steel back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. Utilize stainless steel threaded standoffs welded to exterior of control panel to secure sunshields. All hardware shall be stainless steel. Provide safety hardware to hold the door in an open position.
- C. Components: All motor branch circuit breakers; motor starters and DIN rail mounted control relays shall be of highest industrial quality, securely fastened to the removable back panels with screws and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.
- D. A circuit breaker shall be provided on each control panel as a means of disconnecting power to the control panel. The circuit breaker operating handle shall be installed on the right side of the cabinet not in the door.

The door shall be interlocked from opening when the circuit breaker is in the on position. Do not provide door interlock for lift stations. The circuit breaker operating handle shall have an interlock defeat mechanism for qualified personnel to gain access to the panel without shutting off power.

- E. Control transformers shall be installed where shown to provide 120VAC and 24VAC for control circuits. Transformers shall be fused on the primary and secondary circuits. The transformer secondary shall be grounded on one leg.
- F. All control panel wiring shall be identified at both ends with type written heat shrinkable wire markers with the numbering system shown on the control submittal drawings.
 - 1. Control wiring shall be stranded tinned copper, minimum size #16 AWG (except for shielded instrumentation cable may be #18 AWG), with 600 volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation.
 - 2. Wire shall be guided within control and terminal cabinets by cable supports (duct). Instrumentation and control field cables on the unprotected side of SPD devices within the cabinet shall not run in parallel to the cables on the protected side of the SPD device. Separate cable supports (duct) will be provided.
 - 3. All conductors shall be neatly led to terminations. All connections of stranded wire to screw type terminal blocks shall be by insulated spade lugs, crimp fastened to wire. Provide stranded wire crimp ferrules for all stranded wire connections not requiring spade lugs for screw type terminal blocks.
- G. The control panel shall be provided with nameplates identifying each component, selector switches, pilot lights, etc. Nameplates shall be permanently affixed using an epoxy process. Nameplates shall be laminated plastic, engraved white letters with a black background. List the manufacturer of the control panel cabinet and the control panel builder.
- H. Corrosion Inhibitor Emitter: Provide an industrial corrosion inhibitor emitter on all exterior mounted control panels that will protect internal components of the control panel from corrosion one year. Provide a year supply of spare emitters, for each control panel.
- I. Terminal strips shall be provided for all signals as indicated on the drawings plus all spare conductors as specified. Terminal strips shall be switch type with integral fuses equal to Allen Bradley 1492-H6. Wiring from the control panel to the terminal strips shall be factory installed. All spare

conductors shall be terminated and identified. All terminals over 200V phase to phase shall be covered with approved plastic shields.

J. RELAYS

1. Control circuit switching shall be accomplished with relays. These relays, for interfacing and control applications, shall be the compact general purpose plug-in type having low coil inrush and holding current characteristics. An LED status-indicating light shall be provided with each relay. Contact arrangements shall be as noted or shown, and shall be rated for not less than 10 amperes at 120V ac or 28V dc. Coil voltage shall be as noted or shown. Non-latching relays shall have a single coil. Latching relays shall have two coils, unlatching being accomplished by energizing one coil, and latching being accomplished by energizing the other coil. Relays shall have plain plastic dust covers, test buttons, and mounting sockets with screw terminals and holddown springs. Relays shall be UL recognized. Relays shall be Square D, Allen Bradley, Omron or approved equal.
2. Time on delay functions shall be accomplished with Square-D 9050JCK60V20 timer relays. Provide RK electronics CFB24D-7-2M relay for time off delay applications. Units shall be adjustable time delay relays with the number of contacts and contact arrangements as shown. A neon status-indicating light shall be provided with each relay. Contacts shall be rated for 10 amperes at 120V ac. Integral knob with calibrated scale shall be provided for adjustment of time delay. Initial setting shall be as shown with time delay range approximately three times the initial setting. Time delay rangeability shall be at least 10:1. Operating voltage shall be 120V ac, plus 10 percent, -15 percent at 60-Hz. Operating temperature shall be -20 degrees F to 165 degrees F. Repeat timing accuracy shall be plus or minus 10 percent over the operating range. Units shall be Amerace Corp., Control Products Division, Agastat Series 7000, Cutler-Hammer Series D87, Square D, Allen Bradley, Omron or approved equal.
3. All relays shall have a screw terminal interface with the wiring. Terminals shall have a permanent, legible identification. Relays shall be mounted such that the terminal identifications are clearly visible and the terminals are readily accessible.

K. Panel Operating Controls and Instruments

1. All operating controls and instruments shall be securely mounted on the interior deadfront as detailed on panel enclosure drawings. All controls and instruments shall be clearly labeled to indicate function.

2. Indicator lamps shall be 30mm LED full voltage push to test type and mounted in NEMA 4X (800H) modules, as manufactured by Allen Bradley or SKPI as manufactured by Square D. Lamp modules shall be equipped to operate at 24 or 120 volt input. Lamps shall be easily replaceable from

the front of the control compartment door without removing lamp module from its mounted position. Units shall be heavy-duty, oiltight, push to test industrial type with screwed on prismatic glass lenses in colors as shown, and shall have factory engraved legend plates. LED's shall be high illumination type (5ma at 130V ac).
3. Selector switches shall be 30mm heavy-duty, oiltight, industrial type selector switches with contacts rated for 120V ac service at 10 amperes continuous. Units shall have standard size, black field, legend plates with white markings, as indicated. Operators shall be black knob type. Units shall have the number of positions and contact arrangements and spring return function (if any) as shown. Units shall be single-hole mounting, accommodating panel thickness from 1/16-inch minimum to 1/4-inch maximum. Units with up to four selection positions shall be Allen Bradley 800H, Square D Type K, Cutler-Hammer Type T, or equal.
4. 22mm devices are not acceptable.

L. Process Meters

1. Provide digital programmable process meters with a loop powered display designed for a 4-20MA current loop. Provide minimum 0.5" high, 4-1/2" digit LED display to indicate amplitude of current in the current loop. In general, a loop current of 4ma corresponds to a display indication of 0 percent and a loop current of 20ma corresponds to a display indication of

100 percent. The meter shall be provided with programmable internal scaling adjustment. Provide units with NEMA-4X faceplate rating constructed of silicone coated Lexan and gasketed for NEMA 4 requirements; circuit boards coated for moisture resistance. Provide panel meters for each analog process variable; Pressure, level and flow as indicated equal to Yokogawa, Red Lion, or equal.

M. Phase Monitors

1. Provide ATC Diversified and or Macromatic.

N. Uninterruptable Power Supply (UPS)

1. Provide 24VDC input, 12/24VDC dual output UPS. Puls UB10.241

UPS, no equal.

PART 3 - EXECUTION

3.01 MOUNTING OF EQUIPMENT AND ACCESSORIES

- A. Install and mount equipment in accordance with the Contract Documents, and installation detailed shop drawings. Mount equipment so that they are rigidly supported, level and plumb, and in such a manner as to provide accessibility; protection from damage; isolation from heat, shock and vibration; and freedom from interference with other equipment, piping, and electrical work.
- B. Mount local equipment in cabinets or existing panels as specified. Mount associated terminals on a common panel or rack; all terminals over 200V phase to phase shall be covered with plastic shields.
- C. Provide services of panel manufacturer to test the completed system after installation to assure that all components are operating within the specified range and all interlocks are functioning properly. Panel manufacturer shall certify functional operation and calibration in written startup report. Perform field tests on all completed control assemblies to demonstrate conformance to specifications and functional compatibility.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 26 29 14

CONTROL PANEL (ALUM FEED SYSTEM)

PART 1 - GENERAL

1.1 DESCRIPTION

A. General

1. This part of the Contract Documents covers the general requirements for furnishing and installation of the Alum Feed System.
2. The intent of this specification is to require that the Instrumentation Specialist provide the control system including all Sections of this Specification, i.e., primary elements, panel mounted and miscellaneous field instruments, etc., shall be furnished by a single supplier to assure system uniformity, subsystem compatibility and coordination of all secondary system interfaces. Where specific manufacturers are designated, substitutions will not be accepted. Deviations may be considered in special circumstances but must be approved by the EOR and Owner. The Contractor shall include in his bid the name of the Instrumentation Specialist that will be used to furnish the system as described herein.

B. Scope of Work:

1. Furnish and install all instrumentation and control systems hereinafter specified to perform the intended function. Work shall include all labor, materials and equipment, performance of all work necessary to complete the manufacture, to make factory tests, to prepare and load for shipment, to deliver to the site, to provide programming, calibration, installation supervision, system start-up, services and incidentals required to completely furnish and install a programmable controller based control system with field instruments and control devices for the automation of the Alum Feed Control Panel "and including all work necessary during the Warranty Period.

2. Furnish all tools, equipment, materials, and supplies and perform all labor required to complete the furnishing, installation, validation, start-up and operational testing of a complete control system as specified herein.
3. Auxiliary and accessory devices necessary for system operation or performance, such as transducers or relays to interface with equipment provided under other Sections of this Specification, shall be included whether specified or not.
4. Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as approved by the EOR.

1.2 QUALITY ASSURANCE

- A. The control system as specified in this Specification is an integrated system and therefore shall be provided by a competent, qualified Instrumentation Specialist who shall have total responsibility for the work of this Specification. Entire system installation including process parameter verification, calibration, validation, start-up, testing, and training shall be performed by qualified personnel, possessing all the necessary equipment and who have had a minimum experience of 10 previous projects in engineering, programming and installing of similar instrumentation, control and monitoring systems used for treatment of stormwater runoff. The system shall be integrated using the latest, most modern and proven design and shall, as far as practical, be of one supplier.
- B. The Instrumentation Specialist shall be responsible for the correct selection of all instrumentation and installation of all hardware and secondary systems specified in this Specification.
- C. Prior to the installation of any device which is part of the treatment process, on-site process conditions and the suitability of the device and materials of construction for the stated application shall be verified with the original equipment manufacturer by the Instrumentation Specialist. Unless notified in writing all devices and component part numbers, when provided, shall be assumed to have been verified as having been selected based on actual process parameters and application. Ultimately, the Contractor shall be responsible for all cost associated with replacements and delays due to improper equipment selection.

- D. The Instrumentation Specialist shall be responsible to see that all components of the control system including measuring, indicating, transmitting, receiving, totaling, controlling, alarming devices and all appurtenances are completely compatible, correctly sized for actual process conditions, and properly interface to each other and shall function as outlined. The Instrumentation Specialist shall furnish and install such additional equipment, accessories, etc. as are necessary to meet these objectives at no additional cost to the Owner.
- E. The Instrumentation Specialist shall be a recognized supplier of pumping, instrumentation, control panels, and systems, etc., of the general type and complexity of the system specified herein and shall have been regularly engaged in providing and engineering instrumentation, control, and monitoring systems on a single system responsibility basis for a minimum of 5 consecutive years. The personnel employed for system engineering, supervision, start-up, operational testing and training shall have been regularly employed and factory trained by the Instrumentation Specialist for a minimum of 2 years.
- F. The Instrumentation Specialist shall retain an electrical engineer specializing in the selection and implementation of instrumentation, control, and monitoring systems of the type specified herein for the past 5 consecutive years. References shall be provided for all projects successfully completed by each engineer or software programmer assigned to this project.
- G. Actual installation may or may not be performed by the Instrumentation Specialist, but the Instrumentation Specialist shall be responsible for the technical supervision of the installation to insure that it is proper in all respects.

1.3 RESPONSIBILITY

- A. The Contractor shall be ultimately responsible and shall provide for the verification of process conditions, supply, installation, certification, adjustment, and start-up, of complete, coordinated systems which shall reliably perform the specified functions.
- B. All interconnecting conduit and wiring, between elements of a single secondary control system shall be furnished, installed and connected under the same section as is the secondary control system unless the electrical design plans specifically indicate otherwise.

1.4 SUBMITTALS

- A. Before proceeding with any manufacturing, submit the following for approval in complete bound sets indexed by specification number. Describe and verify all component part numbers for the items being submitted. Submit only complete systems, not pieces of equipment from various systems. Show dimensions, physical configurations, methods of connecting instruments together, mounting details, and wiring schematics. Schematics shall be complete with all components identified by a unique tag reference in accordance with ISA-S5.1 Instrumentation Symbols and Identification. Terminal number identification associated with relays, lights, electrical devices, etc., shall be clearly identified on all drawings. Submit fabrication drawings, nameplate legends, and control panel internal wiring and piping schematic drawings clearly showing all equipment and tag numbers for all components. Submit panel graphic drawings when applicable. Include material specifications listed where applicable.
- B. Include a draft of the theory of operation for all relay circuits including software logic implemented via programmable controllers, that will eventually be included in the operation and maintenance instruction manuals required below.
- C. Each submittal shall be forwarded electronically as a PDF document which indicates the system name, submittal content, project reference, revision date and purpose of the submittal.
- D. Provide the following submittals to the EOR for review and approval:
 1. Hardware Submittal
 - a. Index and Comments
 - (1) Provide a detailed index or Table of Contents identifying each section and its content.
 - (2) If there are any deviations or clarifications to the specifications, they shall be documented in writing in this section. If there are no comments or concerns identified in the submittal, it will be presumed that there are no deviations from the Contract Documents for the system being furnished.

b. Component Data Sheets

- (1) Component Data Sheets shall be specifically prepared for all components being furnished under these Specifications. The purpose of this material is to supplement the generalized catalog information by providing the specifics of each component (e.g., individual component tag ID reference, service, quantity supplied, part number, breakdown and descriptions for all options, scales, ranges, materials of construction, component location reference, and reference to associated drawings).
- (2) Include such other necessary data as would provide a complete and adequate specification for re-ordering an exact duplicate of the original item from the manufacturer at some future date. More than one tag numbered item with the same part number may be included on a sheet.

c. Catalog Cuts

- (1) Manufacturer's standard specification or data sheets shall be clearly marked to delineate the options or styles to be furnished. Standard manufacturer catalog information, descriptive literature, wiring diagrams, and shop drawings shall be provided for all devices, whether electrical or mechanical, furnished under these Specifications. This includes, but is not limited to, pressure switches, gauges, solenoid valves, controllers, indicators, power supplies, switches, lights, relays, timers, circuit breakers, fuses, etc.

2. System Control Panel(s) Drawing Submittal

All drawings shall be provided on a minimum of 11-inch x 17-inch paper with a minimum 300 DPI resolution and tabbed as directed above.

a. Index and Comments

- (1) Provide a detailed index identifying each section and its content.

- (2) If there are any deviations or clarifications to the specifications, they shall be documented in writing in this section. If there are no comments or concerns identified in the submittal, it will be presumed that there are no deviations from the contract documents for the system being furnished.

b. Panel Layout Drawings

- (1) Provide detailed shop drawings for all panels and enclosures. Drawings shall show the location of all exterior and internal panel mounted devices to scale and shall include a panel legend and bill of materials. Layout drawings shall show all major dimensions, front, back, side, and mounting details, as well as all elevations, in inches from the base up, of all rows of components.
- (2) The panel legend shall list and identify all front of panel devices by the components unique tag identifier, all nameplate inscriptions, service legends, and annunciator inscriptions when applicable. Service legends, and nameplate inscriptions shall show size, engraving per line, character height and color. Information may be included on the layout drawing if spacing permits.
- (3) The bill of materials shall include all components mounted within or on the panel that are not listed in the panel legend, and shall include the component identification tag, description, manufacturer, and complete part number for re-ordering. Information may be included on the layout drawing if spacing permits.
- (4) Fabrication drawings shall be submitted for review and shall show all cut-out dimensions, support details, brackets, materials of construction, finish, etc. to be used for fabrication of each panel. Fabrication drawings may be submitted separately after the layout drawings have been approved. Construction of panels shall not be started until the approval of the fabrication drawings is received.

c. Detailed Panel Wiring Diagrams

- (1) Wiring diagrams shall be provided in the form of ladder type schematics with line numbers for all devices. All components shall be identified by a unique identification tag, terminal block numbers, wire sizes and color codes clearly identified, and external interconnections noted. Drawings shall be drawn in “landscape” mode.
- (2) Provide complete terminal identification of all internal and external elements, panels, and junction boxes.
- (3) Polarity of all analog signals shall be shown at each terminal as well as all shielded cable connections and grounding requirements.
- (4) All external panel wiring that must be provided and installed shall be clearly identified as a dashed line.
- (5) All special cables that are provided with purchased equipment external to panels shall be identified as being supplied by the Supplier.
- (6) Wiring diagrams shall show all circuits individually; no common diagrams will be allowed.
- (7) Provide panel power wiring diagrams for all panels. The diagrams shall include all grounding requirements.

d. Control Panel Submittal Format

- (1) Tab 1. Index and Comments
- (2) Tab “N” through “NN” as required:
 - (a) Heat Dissipation and Power Calculations Summary.
 - (b) Panel “A” Layout Drawing (one tab per panel).

- (c) Panel "A" with Fabrication Drawing Legend/ Engravings/Bill of Materials.
 - (d) Panel "A" Power Wiring.
 - (e) Panel "A" Wiring Diagrams.
- (3) Tab "X". Loop Drawings (when applicable)
 - (4) Tab "Y". Installation Details (when applicable)

e. Analog Loop Drawing Submittal

Provide an individual loop wiring diagram for each analog loop showing all terminal numbers, the location of the DC power source, the location of any dropping resistors, polarity, etc. The loop diagrams shall meet the minimum requirements of ISA standard S5.4 approved October 9, 1981, plus the following requirements:

- (1) Loop diagrams shall be in 11-inch by 17-inch format. Only one loop shall be shown on each drawing.
- (2) Reference to supplementary records and drawings, such as installation details, P&IDs, location drawings, wiring diagrams or drawings, and instrument specifications shall be included. Drawings may be included in the Control Panel Drawing Submittal when only a few drawings are required.

f. Instrument Installation Details Submittal

The Instrumentation Specialist shall develop and submit for review, complete installation details for each field mounted device and panel furnished prior to shipment and installation. Common details may be referenced by an index showing the complete instrument tag number, service, location, and device description. Installation details shall be provided as required to adequately define the installation of the components. Drawings may be included in the Control Panel Submittal when only a few are required.

E. Power Requirement and Heat Dissipation Summary

Provide a summary of the power requirements and heat dissipation for all control panels furnished. Power requirements shall state required voltages, currents, and phase(s). Heat dissipation shall be maximums and shall be given in BTU/Hr. Summary shall be supplemented with calculations and show expected temperatures to be maintained for proper control equipment operation.

F. PLC Subsystem Submittal

In addition to the detailed hardware submittal requirements noted herein, the following shall also be provided:

1. Theory of Operation and Logic Descriptions.
2. System block diagram and cabling requirements.
3. Annotated software program listing and I/O address mapping.
4. I/O arrangement and wiring drawings.
5. PLC shall be ALLEN BADLEY 5069-L30ER or approved equal.

G. Operation and Maintenance Manual Submittal

1. Submit a PDF file containing Operation and Maintenance Instruction Manuals and Part Lists to the Owner for all equipment provided. Manuals shall be delivered no later than the equipment shipment date. After installation is complete, update the manuals to reflect any changes which occurred during installation and provide a revised file to the Owner.
2. All manuals shall be original manufacturers literature provided as noted herein above.
3. The Operation and Maintenance Manuals for all equipment shall be combined into a single document. Include in the document not less than the following applicable information for each instrument, component, subsystem and/or control loop.
 - a. Index and Comments
 - (1) Provide a detailed index identifying each tabbed section and its content.

(2) If there are any deviations or clarifications to the specifications, they shall be documented in writing in this section. If there are not comments or concerns identified in the submittal, it will be presumed that there are no deviations from the contract documents for the system being furnished.

b. Bill of Materials

(1) A listing of all the panels, racks, instruments, components, and devices furnished. All components shall be grouped by component type, i.e., pressure switches, pressure gauges, indicators, etc. The list shall contain, as a minimum:

- (a) Instrument, panel, rack or device tag number
- (b) Description
- (c) Quantity supplied
- (d) Reference to component data sheet and/or catalog cut
- (e) Component type

c. Component Data Sheets

d. Catalog Cuts

e. Operation and Maintenance Manuals

Operation and Maintenance manuals shall be submitted for all instruments and devices supplied. The O&M manuals shall contain, as a minimum:

- (1) Operation procedures
- (2) Installation procedures
- (3) Maintenance procedures
- (4) Troubleshooting procedures
- (5) Calibration procedures
- (6) Internal device schematics and wiring diagrams

- (7) Shut-down procedures
- (8) Component parts list
- (9) Detailed circuit operational description including programmable controller ladder diagrams
- (10) Listing of Manufacturers with local telephone numbers and contacts for all instrumentation hardware furnished.

f. Spare Parts and Expendable List

A spare parts and expendable list shall be submitted to include not only those items being supplied, but also any additional items recommended for successful long term operation.

g. Operation and Maintenance Manual Format

- (1) Volume I (or as required) - Hardware
 - (a) Tab 1. Component Index and Comments
 - (b) Tab 2. Theory of Operation
 - (c) Tab "N" through "NN" as required:
 - 1. Component "X" Data Sheet(s) (one tab per component type as required).
 - 2. Standard Manufacturer Catalog Information, and Manufacturers O&M Manual
 - (d) Tab "X" Recommended Spare Parts and Expendable Listing
 - (e) Tab "Y" Current Manufacturers/Local Representatives Telephone/address listing for all major components.
- (2) Volume II

- (a) Tab 1. Index and Comments
- (b) Tab "N" through "NN" as required:
 - 1. Panel "X" Layout Drawing
 - 2. Panel "X" Fabrication Drawing
 - 3. Panel "X" Legend/Engravings/Bill of Materials
 - 4. Panel "X" Power Wiring
 - 5. Panel "X" Wiring Diagrams
- (c) Tab "X" Loop Drawings (when applicable)
- (d) Tab "Y" Installation Details (when applicable)

H. System Calibration and Test Documentation Submittal

- 1. The Instrumentation Specialist shall submit an example of each type of Instrument Calibration Report and Loop Functional Test Report that will be used to verify that all preliminary calibration and testing has been performed and the system is considered, by the Instrumentation Specialist, to be ready for the Owner's acceptance testing.
- 2. After approval of the examples, the Instrumentation Specialist shall prepare Loop Functional Test Report(s) for each loop and an Instrument Calibration Sheet for each active element (except simple hand switches, lights, etc.). These sheets shall be completed and submitted to the Owner after completion of the operational availability field tests.
 - a. Instrument Calibration Reports - An Instrument Calibration report shall be used to certify that each instrument requiring calibration has been calibrated to its published specified accuracy shall be submitted to the Owner. This report shall include all applicable data as listed below plus an area to identify any defects noted, corrective action required, and corrections made.
 - (1) Facility identification (Name, location, etc.)

- (2) Loop identification (Name or function)
- (3) Equipment tag and serial numbers
- (4) Scale ranges and units
- (5) Test mode or type of test
- (6) Input values or settings
- (7) Expected outputs and tolerances
- (8) Actual readings at 0, 10, 25, 50, 75, 90 and 100 percent of span
- (9) Percent of error for each reading
- (10) Explanations or special notes as applicable
- (11) Date, time, and weather conditions
- (12) Tester's certification with name and signature

b. Loop and Functional Test Reports - Submit a sample of each type of Loop and Functional Test Report form that will be used in verifying all control system functions as follows:

- (1) Loop Status Report - For each function that can be demonstrated on a loop-by-loop basis:
 - (a) Each form shall include:
 1. Project name
 2. Loop number
 3. Loop description
 4. Test procedure description, with a space after each specific test to facilitate sign off on completion of each test.

5. For each component: tag number, description, manufacturer, and data sheet number.
6. Space for sign off and date by the Instrumentation Specialist

- (2) Functional Acceptance Test Report - For those functions that cannot be demonstrated on a loop-by-loop basis.

Each form shall include a listing of the specific tests to be conducted. With each test description, the following information shall be included:

- (a) Specification page and paragraph of function to be demonstrated
- (b) Description of function
- (c) Test procedure description
- (d) Space after each specific test to facilitate sign off on completion of each test

- (3) Instrumentation Specialist's Installation Certification Reports

Upon completion of all preliminary calibration and functional testing, the Instrumentation Specialist, shall submit a certified report for each control Panel "and its associated field instruments certifying that the equipment (1) had been properly installed under his or her supervision, (2) is in accurate calibration, (3) was placed in operation, (4) has been checked, inspected, calibrated, and adjusted as necessary, (5) has been operated under maximum power variation conditions and operated satisfactorily, and (6) is fully covered under the terms of the guarantee.

I. Functional Acceptance Test Procedures Submittal

1. Submit for approval not later than 30 days prior to the functional acceptance test demonstration, a written plan for demonstrating

that each device and function of the equipment provided under these specifications meets the specified operational requirements.

2. The plan shall detail procedures to be used in the functional acceptance testing of all systems. The plan shall include a description of test methods and materials that will be utilized for testing each system.
3. Immediately correct defects and malfunctions with approved methods and materials in each case and repeat the testing.

1.5 SYSTEM TESTING AND ACCEPTANCE

A. Factory Tests

1. Factory Testing

Prior to delivery, each panel shall have been completely tested by the manufacturer's personnel. Provide a report certifying the control panel(s) are fully operable and meet the Specifications. If upon arrival of the Owner, the panel tests have not been performed, the Instrumentation Specialist may be liable for back charges for all costs associated with the visit by the Owner. The necessary panel tests shall be repeated in the presence of the Owner. The Owner shall have the right to check all test observations. The Instrumentation Specialist shall demonstrate that the results of the Factory Tests are accurate. As a minimum, tests shall verify the following:

- a. Accuracy of panel instruments for 4-20 mA inputs and outputs
- b. Location of interface wires on terminal blocks
- c. Function of discrete panel components
- d. Control logic

2. Witnessed Factory Testing

- a. Inspection and test of materials and equipment shall be made by the EOR (or representative) at the place of manufacturer prior to shipment, to verify that the completed control panel(s) meet the requirements of the specifications. Shipment shall not be made until receipt

of written approval from the EOR after satisfactory completion of shop tests.

- b. The manufacturer furnishing materials, equipment and labor for the fabrication of the panel(s) shall afford the necessary facilities for such shop inspection and tests. The Instrumentation Specialist shall give the EOR written notice ten (10) working days prior to the estimated date when the equipment will be ready for the inspection and witnessed shop test.
- c. Sufficient time, ample space, and necessary assistance shall be provided by the manufacturer to assure inspection and testing to the satisfaction of the EOR.
- d. The Instrumentation Specialist shall furnish all power, labor, materials, and properly calibrated instruments required for the shop tests.
- e. The EOR reserves the right to reject defective materials, poor workmanship and items that are not in accordance with the requirements of the specifications.

B. Installation Supervision

Furnish the services of authorized factory personnel specially trained and experienced in the installation of the equipment to: (1) supervise the installation in accordance with the approved Instruction Manuals; (2) be present when the instruments and equipment are first delivered, installed, and put into operation; (3) inspect, check, adjust as necessary, and approve the installation; (4) calibrate the instruments, in accordance with the Specifications herein, until all trouble or defects are corrected and the installation and operation are acceptable.

C. Preliminary Calibration and Functional Testing

- 1. After approval of the Loop Status Report and Calibration Worksheets described herein, the Instrumentation Specialist shall prepare Loop Status Report(s) for each loop and an Instrument Calibration Worksheet for each active element (except simple hand switches, lights, etc.). These sheets shall be completed, signed, and submitted to the Owner after the Preliminary Calibration and Functional Testing is completed.

2. Although the Preliminary Calibration and Functional Testing does not require witnessing, the equipment Instrumentation Specialist shall maintain the reports and calibration worksheets at the job-site and make them available for the Owner's review at any time.
 - a. Preliminary Calibration: Provide the services of factory trained instrumentation technician, tools and equipment to field calibrate each instrument to its specified accuracy in accordance with the manufacturer's specifications and instructions for calibration.
 - b. Functional Testing: Provide Loop Status Report(s) for verifying all control system functions as follows:
 - (1) Provide the services of factory trained and field experienced instrumentation engineer(s) to validate each system to verify that each system is operational and performing its intended function within system tolerance. System tolerance is defined as the root-mean-square sum of the system components specified accuracies from input to output.
 - (2) Validate calibration of each system by simulating inputs at the first element in the loop (i.e., sensor) of zero, 10, 25, 50, 75, 90 and 100 percent of span, or on/off and verify loop output devices (i.e., recorder, indicator, alarm, etc. except controllers). During system validation, make provisional settings on levels, alarms, etc. Verify that all logic sequences operate in accordance with the specifications.
 - (3) Cause malfunctions to sound alarms or switch to standby to check system operation. Check all systems thoroughly for correct operation.
 - (4) Immediately correct all defects and malfunctions disclosed by tests. Use new parts and materials as required and approved and retest.
 - c. Instrumentation Specialist's Certified Reports: Upon completion of the Preliminary Calibration and Functional

Testing, the Instrumentation Specialist shall submit a certified report for each control panel and associated field instruments certifying that the equipment (1) had been properly installed under his supervision, (2) is in accurate calibration, (3) was placed in operation, (4) has been checked, inspected, calibrated, and adjusted as necessary, (5) has been operated under maximum power variation conditions and operated satisfactory.

D. Functional Demonstration Testing

Upon completion of the Preliminary Calibration and Functional Testing, re-test all systems in the presence of the EOR (or representative). The intent of this test is to demonstrate and verify the operational interrelationship of all instrumentation systems. This testing shall include, but not be limited to, all specified operational modes, taking process variables to their limits (simulated or actual) to verify all alarms, failure interlocks, and operational interlocks between systems and/or mechanical equipment. Notify the Owner in writing a minimum of 48 hours prior to the proposed date for commencing the test. Upon successful completion of this test the Instrumentation Specialist shall begin the Operational Acceptance Test Demonstration.

E. Operational Acceptance Test Demonstration

Upon completion of the Functional Demonstration Testing, re-test all systems under actual process conditions in the presence of the EOR and the Owner's Operators. The intent of this test is to demonstrate and verify the operational interrelationship of all instrumentation systems to the Owner's Operators. This testing shall include, but not be limited to, all specified operational modes, taking process variables to their limits (simulated or actual) to verify all alarms, failure interlocks, operational interlocks between systems and/or mechanical equipment, and making final adjustments. Notify the Owner in writing a minimum of 48 hours prior to the proposed date for commencing the test. Upon successful completion of this test, the Instrumentation Specialist shall begin the 60-Day Operational Test.

F. 60-Day Operational Test

1. After completion of the Operational Acceptance Test Demonstration, the Instrumentation Specialist shall be responsible for the operation of the supplied system for a period

of 60 consecutive days, under conditions of full process operation, without a single non-field repairable malfunction.

2. During this test, plant operating and Instrumentation Specialist personnel shall be present as required. While the test is proceeding, the Owner shall have full use of the system.
3. If any failures should occur that cannot be corrected by the Contractor within 24 hours, or more than two similar failures of any duration, the failure will be considered as a non-field-repairable malfunction. The system shall be repaired and the 60-day test period shall be re-started. Owner reserves the right to set the schedule.
4. Down times due to power outages or other factors outside the normal protection devices or back-up power supplies provided, shall not contribute to the availability test times above.
5. Upon successful completion of the system availability testing, submit a certified report, with substantiating data sheets, indicating that the equipment furnished meets all the functional requirements specified herein. The Owners will countersign this report and it shall constitute acceptance of the control system hardware.

1.6 FINAL DOCUMENTATION

A. Reproducible Drawings

The Instrumentation Specialist shall submit a digital version of complete schematics, wiring diagrams and installation drawings to include all installed field and panel instruments, mounting details, point-to-point diagrams with cable, wire, and termination numbers. Drawings shall be a record of work as actually constructed and shall be labeled "As-Installed".

1. Loop Diagrams
2. Panel Construction Drawings and Wiring Diagrams
3. Interconnecting Wiring Diagrams
4. Instrument Installation Details

B. Software

Provide digital copies of all programming software, application programs, and source code utilized to generate, annotate, and debug

all software provided. Programming software, detailed programming instructions, software keys, cables, and licenses shall be provided for all programmable devices, i.e., PLC, SCADA, controllers, and smart transmitters. Special devices used in programming supplied hardware shall be provided. It is the intent that the Owner shall have the full capability to re-program and modify any application on-site without the need to purchase additional software or hardware.

C. Operation and Maintenance Manuals

Documentation for equipment provided under these specifications shall be provided within the Operation and Maintenance Manuals. The Operation and Maintenance Manuals shall be provided as stipulated in the contract documents.

1.7 TRAINING REQUIREMENTS

A. General

The Instrumentation Specialist shall conduct group training of Owner's designated personnel in the operation of all Instrumentation, and control and monitoring equipment furnished. Include instruction covering basic system theory, operating principles and adjustments, routine maintenance and repair, and "hands-on" operation.

Training specific to the system hardware shall be provided as stipulated in the contract documents between the Owner and EOR.

B. Operator Training

Operator training shall include instruction in the use of all control system hardware and software furnished. A detailed description of the system furnished and all equipment start-up, shut-down, and maintenance procedures shall also be provided to the Owner in the Operations and Maintenance Manual. As a minimum, the format for the training material shall be as follows:

1. General system description and overview
2. Process and Instrumentation Diagrams
3. Sequence of Operation
 - a. Panel Layout Drawing
 - b. Legend

- c. Alarm Handling
 - d. System Start-Up
 - e. System Shut-Down
 - f. Operator Adjustment and Setpoints
 - 4. General Troubleshooting Techniques
 - 5. Recommended Maintenance Procedures
 - 6. Recommended Spare Parts
- C. Maintenance Training
- 1. The Instrumentation Specialist shall conduct maintenance training shall and instruction in the calibration, maintenance, programming, and repair for all systems furnished.
 - 2. Maintenance training shall include instruction in the maintenance of all control system hardware and software furnished. A detailed written description of the system furnished and all equipment start-up, shut-down, troubleshooting, and maintenance procedures shall be provided to each person attending the training sessions. As a minimum, the format for the training material shall be as follows:
 - a. General system description and overview
 - b. Process and Instrumentation Diagrams
 - c. Sequence of Operation
 - (1) Panel Layout Drawing
 - (2) Legend
 - (3) Alarm Handling
 - (4) System Start-Up

 - (5) System Shut-Down
 - (6) Operator Adjustment and Setpoints
 - d. Detailed review of all schematic diagrams
 - e. Detailed review of all software functions using actual software listings

- f. Detailed programming instruction of hardware furnished unless otherwise noted
 - g. Detailed calibration procedures for all furnished
 - h. Recommended Maintenance Procedures
 - i. Recommended Spare Parts
- D. Training shall not be performed concurrently with start-up or trouble shooting.

E. Final Acceptance

Final Owner acceptance is defined as a point in time when (1) all training has been performed, (2) final "As Installed" documentation and software (when applicable) have been received and approved, (3) the system has successfully passed the 60-day operational test period, and (4) all punch list items have been resolved. Only at this time, will final payment be released.

F. Guarantee and Warranties

All work outlined in these Specifications shall be warranted for a period of one (1) year or the duration of the manufacturer's warranty, whichever is greater, from the date of final acceptance by the Owner. The warranty shall include all materials, labor, and shipping (if necessary). With respect to instruments and equipment, the warranty shall cover:

- (a) improper assembly or erection;
 - (b) defective workmanship or materials; and
 - (c) leakage, breakage, or other failure not caused by Owner misuse.
- All warranties shall be provided by the Contractor to the Owner, with the Owner named as beneficiary.

PART 2 - PRODUCTS

2.1 JOB CONDITIONS

Exercise care (1) to secure neat arrangement of all piping, valves, conduit, and like items, and (2) to overcome structural interference. Verify dimensions and conditions at the place of work, and install materials and equipment in the available spaces.

2.2 MATERIALS AND STANDARD SPECIFICATIONS

Provide instruments, equipment and materials suitable for service conditions and meeting standard specifications such as Instrument Society of America (ISA). The intent of this Specification is to secure instruments and equipment of a uniform quality and manufacture throughout the facilities; i.e., all instruments furnished by the Instrumentation Specialist of the same type of function shall be by the same manufacturer. This allows the stocking of the minimum number of spare parts.

2.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

Box, crate or otherwise enclose and protect instruments and equipment during shipment, handling and storage. Keep all equipment dry and covered from exposure to weather, moisture, corrosive liquids, and gases or any element which could degrade the equipment. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repair any damage as directed and approved.

2.4 COMPONENT TAG NUMBERING SCHEME

All control equipment shall be identified by unique alphanumeric code or tag number based on the latest Instrument Society of America standards S5.1.

Tag Numbering Scheme: a-b-c-d

Equipment tagging shall be based on the following scheme:

DESCRIPTION	TAG	EXPLANATION
a. ISA Functional Identification	HS	Hand Switch
b. Loop Number	23	Loop 23
c. Component Number	2	Second HS in Loop
d. Unit	3 (When Required)	Third Identical Process Control System

Example 1: HS-23-2-3

Tag number identifies a Hand Selector Switch. It is part of Loop 23 and the second hand selector switch in the loop. This is the third identical process unit (i.e., three identical pump controls). It is also the only hand selector switch in the loop.

Example 2: HS-23

Tag number identifies a Hand Selector Switch in Loop 23. It is also the only hand selector switch in the loop.

2.5 INSTRUMENT IDENTIFICATION

- A. All components provided, both field and panel mounted, shall be provided with permanently mounted name tags bearing the entire tag number of the component. Panel mounted tags shall be white with black lettering lamicoïd plastic; field mounted tags shall be stamped stainless steel.
- B. Nameplates for panels and panel mounted equipment shall be as indicated on the Drawings.
- C. Field mounted tags shall be 16-gauge, 304 stainless steel with 1/2 inch high characters.
- D. Tags shall be attached to equipment with a commercial tag holder using a stainless steel band with a worm screw clamping device or by a holder fabricated with standard stainless steel hose clamps and meeting the same description. In some cases where this would be impractical, use 20 gauge stainless steel wire.
- E. For field panels or large equipment cases use stainless steel screws, however, such permanent attachment shall not be on an ordinarily replaceable part. In all cases, the tag shall be plainly visible to a standing observer and not obscure adjustment ports or impair the function of the instrument. Field mounted control stations, recorders or indicators shall have a nameplate indicating their function and the variable controlled or displayed. Nameplate shall be attached by one of the above methods.

2.6 STANDARD LIGHT COLORS AND INSCRIPTIONS

Unless otherwise noted, the following color code and inscriptions shall be followed:

TAG FUNCTION	INSCRIPTION(s)	COLOR
ON	ON	RED
OFF	OFF	GREEN
OPEN	OPEN	RED
CLOSED	CLOSED	GREEN
LOW	LOW	GREEN
FAIL	FAIL	AMBER
HIGH	HIGH	AMBER
AUTO	AUTO	WHITE
MANUAL	MANUAL	YELLOW
LOCAL	LOCAL	WHITE
REMOTE	REMOTE	AMBER

Lettering shall be black on white with amber, red, white and green lenses.

2.7 STANDARD PUSHBUTTON COLORS AND INSCRIPTIONS

TAG FUNCTION	INSCRIPTION(s)	COLOR
OO	ON	RED
	OFF	GREEN
OC	OPEN	RED
	CLOSED	GREEN
OCA	OPEN	RED
	CLOSED	GREEN
	AUTO	WHITE
OOA	ON	RED
	OFF	GREEN
	AUTO	WHITE
MA	MANUAL	YELLOW
	AUTO	WHITE
SS	START	RED
	STOP	GREEN
RESET	RESET	RED

All unused or non inscribed buttons shall be black. Lettering shall be black on white with yellow, red, green and white buttons.

2.8 ELECTRONIC EQUIPMENT

If the equipment is electronic in nature, provide industrial duty, solid state equipment to the greatest extent practicable. Select components of construction for their suitability and reliability. Employ adequate component derating to preclude failures because of transients and momentary overloads reasonably expected in normal operation. Where conduit connection is

provided for mounting a surge/lightning suppressor directly to the instrument, the arrestor shall be so mounted.

2.9 EQUIPMENT OPERATING CONDITIONS

All equipment shall be rated for normal operating performance with varying operating conditions over the following ranges:

- A. Environmental Conditions: Equipment rated NEMA 3R or NEMA 4X shall be suitable for the following environmental conditions:
 - 1. Temperature: 20-130°F.
 - 2. Relative Humidity: 10-110 percent.
 - 3. Classification: Non-hazardous.

2.10 SIGNAL ISOLATORS, CONVERTERS AND CONDITIONERS

Insure that input-output of all instruments and control devices (whether furnished by the Instrumentation Specialist or not) are compatible. Analog signals between field and panels shall be 4 to 20 mA dc unless specifically approved otherwise. Granting such approval does not relieve the Instrumentation Specialist from the compatibility requirement above. Provide signal isolators and converters as necessary to obtain the required system performance. Mount the devices behind control panels or in the field at point of application, as required for accurate signal acquisition.

2.11 AUXILIARY CONTACTS BY OTHERS

Provide instruments and equipment to connect to auxiliary contacts provided by others for alarms, status of equipment, interlocking, and other functions as indicated and as specified herein.

2.12 ELECTRICAL

- A. The construction work shall include all power supply wiring, instrumentation wiring, interconnecting wiring and equipment grounding as indicated, specified, and required.
- B. Wiring installations shall include cables, conductors, terminals, connectors, heat shrunk wire markers on all terminations, conduits, conduit fittings, supports, hardware, and all other required materials.
- C. Provide the materials and complete all the required installations for equipment grounding.

- D. Incidental items not specifically included in the Contract Documents that can legitimately and reasonably be inferred to belong in the instrumentation work shall be provided and installed by the Instrumentation Specialist at no additional cost to the Owner.
- E. Ring out all existing and proposed signal wiring prior to termination. Provide wire number tags marked in indelible waterproof form of slip-on type and heat shrunk for each existing and proposed wire termination point in the Panel “and field. Wire tagging shall identify the destination point of the wire and when applicable, shall include the signal polarity for analog signals. Each destination point shall be coded as follows:

Destination ID - Terminal Block ID - Terminal Number - (Polarity)

2.13. ELECTRICAL TRANSIENT PROTECTION

- A. All instrument and control equipment mounted outside of protective structures (field mounted equipment) shall be equipped with suitable surge-arresting devices to protect the equipment from damage due to electrical transients induced in the interconnecting lines from lightning discharges or nearby electrical devices. Both power and signal circuits shall be protected with surge and transient protectors installed at the source and destination ends of the circuits. Protective devices used on 120 V AC inputs to field mounted equipment shall be secondary valve surge protectors conforming to the requirements of IEEE Standard 28-1972 (ANSI C62.1-1971).
- B. Surge and transient protectors shall be normally connected to the electrical system ground. When an electrical system ground is not available near the device, the protectors shall be connected to a ground rod 20 ft. in length by 3/4 inch in diameter and located within 10 feet of the device.
- C. Protectors for signal circuits at the field transmitter shall be EDCO SS64 Series 06, 1669-02, and PC 642 in panels. Protectors for 120 volt power circuits shall be UL listed EDCO HSP Series secondary arrester.

2.14 PROCESS CONNECTIONS

Provide instrument piping, tubing, and capillary tubing to meet the intended process service and ambient environmental condition for corrosion resistance, etc. All instrument pneumatic tubing shall be stainless steel with stainless steel fittings. Slope lines according to service to promote self

draining or venting back to the process. Terminate connection to process lines or vessels in a service rated block valve that will permit closing off the sense line or removal of the element without requiring shut down of the process. Include drip legs and blow-down valves for terminations of sense lines at the instruments when mounted such that condensation can accumulate.

2.15 PAINTING

- A. Provide factory paint for all instruments and equipment. Provide paint as required for non-stainless steel structural supports, brackets, etc.

2.16 CORROSION PROTECTION

- A. All control panels, enclosures, and other equipment containing electrical or instrumentation and control devices, including spare parts, shall be protected from corrosion through the use of corrosion-inhibiting vapor capsules. Prior to shipment, the capsules shall be provided within the shipping containers and equipment as recommended by the capsule manufacturer's recommendations. All capsules shall be replaced by the Contractor just prior to Owner's final acceptance of the equipment. The corrosion-inhibiting vapor capsules shall be Northern Instruments Model Zerust VC or Hoffman Model A-HCI. NEMA 4X and NEMA 3R panels shall be provided with breather/drains, Crouse-Hinds Model ECD18; or approved equal.

2.17 SPARES AND MAINTENANCE MATERIALS

- A. Deliver to Owner, as directed, the following items as specified herein. Include an itemized list in a letter of transmittal with each shipment.
- B. Materials shall be delivered in the manufacturer's original containers labeled to completely describe contents and equipment for which it is furnished.
 - 1. One fuse of each size and type for every five used but no less than five of each type.
 - 2. One circuit breaker of each size and type for every five used but no less than one of each type.
 - 3. One relay of each type for every five used but no less than one of each type.

4. One status light bulb for every five used but no less than five of each type.
5. One indicating lamp assembly for every five panel mounted lamp assemblies used but no less than one of each type.
6. One switch assembly for every five used but no less than one of each type.
7. One transient protector for every five used but no less than one of each type.
8. All other spare parts as recommended by Manufacturer.

2.18 WORKMANSHIP

A. General

1. Install materials and equipment in a workmanlike manner utilizing craftsman skilled in the particular trade. Provide work which has a neat and finished appearance.
2. Coordinate work with the Owner, and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the facilities during construction.

B. Protection During Construction

Throughout this Contract, the Contractor shall provide protection for materials and equipment against loss or damage and the effects of weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions. Specific storage requirements shall be in accordance with the Owner reviewed Contractor recommendations.

C. Material and Equipment Installation

Follow manufacturer's installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between manufacturer's instructions, and these Contract Documents, follow the Owners decision, at no additional cost to the Owner. Keep copy of manufacturer's installation instructions on the job site available for review at all times.

D. Removal or Relocation of Materials and Equipment

Where existing materials and equipment are removed or relocated, remove and deliver to the Owner all materials no longer used unless otherwise directed by the Owner. Repair affected surfaces to conform to the type, quality, and finish of the surrounding surface in a neat and workmanlike manner. Follow any specific instructions by the Owner.

E. Cleaning and Touch-up Painting

Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch-up scratches, scrapes, or chips in interior and exterior surfaces of panels and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish.

F. Panels and Panel-Mounted Equipment

Panels and panel-mounted equipment shall be assembled to the maximum extent practicable at the factory. No work, other than correction of minor defects or minor transit damage, shall be done on the panels at the job site.

G. Electrical

1. Arrange wiring neatly, cut to proper length, and remove surplus wire. Provide abrasion protection for any wire bundles which pass through holes or across edges of sheet metal.
2. Wiring shall not be spliced or taped except at the device terminals or terminal blocks.
3. Use manufacturer's recommended tool with the proper sized anvil, for all crimp terminations. No more than one wire may be terminated in a single crimp lug and no more than two lugs may be installed on a single screw terminal.

H. Inspections

1. All materials, equipment, and workmanship shall be subject to inspection at any time by the Owner. Correct any work, materials, or equipment not in accordance with these Contract Documents or found to be deficient or defective in a manner satisfactory to the Owner at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 ALUM FEED PUMP STATION CONTROL PANEL

A. General Design

1. The alum feed pump shall have the following functions.

The motor speed and resulting output from the alum pump shall be controlled automatically by the signal from the control panel or in manual mode by an Operator Interface Terminal.

2. Control Parameter Configuration

- a. The operator selects the mode of control from the function keypad. (i.e., F1 initiates normal operating parameter control, F2 initiates storm event simulation)
- b. The operator shall set the time delay parameters for automatic operation.
- c. The operator shall set the time between pumping cycles.
- d. The operator shall set the dosage rate proportional to the carrier water pumping rate and pH monitor.

3. Automatic Operation

- a. The operator selects the normal mode of control from the OIT.
- b. The operator changes the OIT HAND / OFF / AUTO switch to the AUTO position.
- c. The operator is prompted to start the automatic operation.
- d. Once prompted, the control system shall monitor the pH of the carrier water pumping through the system. After a pre-set time delay, if any, the control system shall start the alum metering pump and vary speed as a function of the pH in the carrier water. The metering pump shall stop after the pre-set operational time for a specific zone or if the carrier water pH reaches the pre-set minimum pH value. The next pumping cycle shall not occur until the

timing value between pumping cycles is met. The on flow rate shall be adjustable in 0.1 cfs increments.

4. Manual Operation

- a. The operator changes the OIT HAND / OFF / AUTO switch to the Manual position.
- b. The metering pump shall start and speed varied based upon the manual setting in the OIT.

5. All control setpoints shall be adjustable via the OIT. Adjustments shall be menu driven for ease of operation. The use of hand held programming units or programming language will not be accepted.

6. All set point shall be input and read in direct engineering units.

7. Programming Specifics

- a. The PLC shall be programmed to communicate with a touchscreen OIT.
- b. Provide the following screens on the OIT
 - (1) Graphic depicting piping and process flows and status.
 - (2) Alum flow data and pH logging and trending for 30-days.
 - (3) Time delay and pumping cycle screen.

B. System Start-up

1. Initial system power up.

Prior to turning on power to the system, verify that all pump selector switches are in the "Off" positions. When power is applied to the control panel for the first time, the Programmable Logic Controller (PLC) shall consider this application as if a power failure condition occurred and has now returned to normal.

2. Reset any alarms that may be present.

If any alarms are flashing, the alarms can be reset by pressing first the "Alarm Silence" and then the "System" pushbuttons. Any conditions that must be manually reset can be accomplished by the "System Reset" pushbutton.

C. System Shutdown

1. Power Failures

a. Brief Power Interruptions:

- (1) When a brief power failure occurs and then is restored the pumps shall be automatically restarted in an operator adjustable, time staggered sequence to avoid system overload. The system shall not require operator assistance to restart the carrier water and alum feed pumps.

b. Sustained Power Interruptions:

- (1) If power is lost for a sustained period of time all pumps in, "Auto" control will automatically be restarted when the normal power has been restored.

c. Programmable Logic Controller Failure

- (1) If the Programmable Logic Controller stops operating and power is available, the pumps will remain in last state. When the PLC is restarted, the pumps will automatically switch back to PLC control.

D. Shutdown Alarm Logic

PLC Alarm logic shall be per standard I.S.A. Sequence. Failures are identified by the following logic table:

FIRST ALARM WITH MANUAL RESET SEQUENCE

CONDITION		FIELD CONTACT	ALARM LIGHTS
Normal		Normal	Off
Alarm	First	Abnormal	Fast Flashing
Alarm	All Subsequent	Abnormal	Slow Flashing
Silence	First	Abnormal	Fast Flashing

Silence	All Subsequent	Abnormal	Slow Flashing
Acknowledge	First	Abnormal	Slow Flashing
Acknowledge	All Subsequent	Abnormal	Steady On
Alarm Reset		Normal	Off
Lamp Test		Normal	On

E. System Shutdown Conditions

WARNING: To ensure proper operation and safety of the pumps, all interlocks must be enabled at all times.

F. Shutdown Recovery

Procedure

Annunciation

1. A fast flashing light indicates the first condition that caused the failure.
2. Subsequent alarms are indicated by a slow flashing light only.

G. System Resets

Alarm Acknowledge: The ALARM ACKNOWLEDGE push-button is used to acknowledge any alarm. The first alert alarm will change from the intermittent fast flashing indication to a slow flashing indication. All subsequent alarms will go from fast flashing to steady on indication.

1. Alarm Reset

The ALARM RESET pushbutton is used after an alarm problem is repaired to reset all alarm indications back to normal.

H. Local Control Panel Device Descriptions

1. Pump "Hand" - "Off" - "Auto" Selector Switch

The carrier water and alum feed pumps shall be provided with a HOA selector switch via the OIT. In the Hand position, the associated pump shall be started independent of the PLC controls. In the "Off" position, the pump shall be considered Out-Of service and shall not be capable of being started from the control panel. In the "Auto" mode of operation the pump

shall be controlled automatically by the PLC, as required. Status of each position of the switch shall be monitored by the PLC.

I. PLC Connections:

The following data shall be available in the PLC image tables:

1. Analog Signals:

- a. Analog input: 4-20 mA DC stormwater flow
- b. Analog input: 4-20 mA DC Pump No.1 speed
- c. Analog output: 4-20 mA DC Pump No.1 speed control
- d. Analog input: 4-20 mA tank level

2. Discrete Signals

- a. PLC Failure
- b. Alum pump in AUTO, OFF, MANUAL
- c. Alum pump start/stop control
- d. Alum pump SCR failure

- e. Pump run
- f. Reset
- g. Acknowledge

J. Control Panel Components

1. General:

- a. Unless otherwise approved by the EOR, all panels shall be constructed of painted NEMA 3R 316 stainless steel. Instrument arrangement shall be as shown, with minor modifications as may be required for the particular equipment furnished. Modifications shall be subject to the approval of the EOR.
- b. All panels shall be completely fabricated, instruments installed, wired, and plumbed at the factory.
- c. Panels shall be of sufficient size to adequately enclose all instruments plus 25 percent ample interior clearance to allow for installation, general servicing, future additions, and maintenance of the instruments. Weight of instruments shall be supported by channel supports where required.

2. Panel Mounting

a. Panel Component Arrangements

- (1) Panel face mounted equipment shall consist of pilot-lights, pushbuttons, selector switches, meters, indicating timers, etc. Spacing between horizontal rows of components shall be 1-1/2 inches center to center minimum; spacing between vertical columns of components shall be 1-7/8 inches center to center minimum.
- (2) The distance from the bottom row of components to the floor shall be not less than 36-inches. The top row of recording and indicating instruments shall be centered approximately 60 inches above the floor. The maximum height for annunciator windows shall be 85 inches above the floor. In general, all indicating lights, pushbuttons, etc. shall be mounted in accordance with the sequence of operation from left to right and top to bottom.

b. Rear of Panel Component Arrangements

- (1) All relays, timers, etc. installed on each panel subplate, shall be provided with a minimum spacing between the component and the wire duct of 1-1/2 inches above and one inch below. Minimum spacing between adjacent components shall be 1/4- inch.
- (2) A minimum of 2-inches shall be provided between terminal strips and wire ducts or terminal strips and terminal strips. In general, terminal strips shall be mounted vertically near the outer edges of the subplate.
- (3) Subplates shall have a minimum of 25% spare mounting space, and terminal strips shall have a minimum of 20% installed spare terminal blocks.

3. Control Panel Interior Components:

a. General

- (1) All components and circuits used shall be subject to review and approval by the Owner. All switching circuits shall be checked and verified for specified performance by testing before shipment. All wiring shall comply with the latest applicable local and N.E.C. codes. Non-conforming circuits shall be corrected and re-tested.
- (2) Each device requiring power shall be wired so that when wires are removed from any one device, power will not be disrupted to any other device.
- (3) One isolated, N.O. spare contact shall be provided on each relay.
- (4) Control device contacts going to high voltage equipment for motor control shall be rated 240 V AC/125 V DC at 10 amps. The contacts shall handle 50 amps inrush on "make" at 120 V AC and one amp on "break" at 125 V DC.
- (5) Fuses shall not be allowed where protection by circuit breakers will not void the warranty of the device.

b. Power Distribution Within Panels:

- (1) A main circuit breaker shall be provided within the control panel. A service description for each breaker shall be clearly identified inside the distribution panelboard.
- (2) Additional branch breakers shall be added as required. No more than 20 devices shall be feed from any one branch breaker. Fuse protection shall not be permitted unless provided as an integral part of a device or where breaker protection cannot be provided. Where fuse blocks are provided, they shall be the fusible disconnect switch type with blown fuse indicators. Branch circuit breakers rated for services of 0.1 to 15 amps shall be panel mounted.

- (3) A summary of the power requirements for each control panel furnished shall be submitted and indicated within each panel. Power requirements shall state required voltages, currents, and phase(s). Summary shall be supplemented with calculations.

c. Signal Switching:

- (1) Signals shall be switched by dry circuit type relays or switches.
- (2) 4 to 20 mA loops shall not be interrupted during switching.
- (3) Switching transients in any associated signal circuit shall not exceed +0.2 mA or +0.05 V depending on the signal type.

d. Relays:

- (1) Relays shall be provided as necessary to perform switching functions required of control panels and other control circuits. All relays shall have screw type terminal interface. Terminals shall have a permanent, legible identification. Relays shall be mounted such that the terminal identifications are clearly visible and all terminals are readily accessible.
- (2) General purpose relays shall be used for logic and switching power to external loads and shall be DIN rail mounted, general purpose, medium power, industrial type. Minimum mechanical life expectancy shall be 10,000,000 operations and electrical life expectancy of 100,000 operations at rated load. They shall be of the dust cover enclosed, plug-in type, with 8 or 11 pin, screw terminal, snap-on sockets. Relays shall have a maximum of three form C contacts rated for 10 amperes at 120 V AC and be equipped with coil status indicator lamps and hold down springs. Relays shall be by Potter-Brumfield series KRPA, KUP, or approved equal.

- e. Power Supplies:
 - (1) Provide dc power supplies as required to power instruments requiring external dc power, including two-wire transmitters and dc relays.
 - (2) Power supplies shall convert 120 V AC, 60-Hz power to dc power of the appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that the instruments being supplied can operate within their required tolerances.
 - (3) Output over-voltage and over-current protective devices shall be provided with the power supply to protect the instruments from damage due to power supply failure and to protect the power supply from damage due to external failure. Provide NEMA 1 enclosure for all power supplies. Power supplies shall be mounted such that dissipated heat does not adversely affect other components.

- f. Wiring: Wiring within panels, consoles, racks, and cabinets shall meet the following requirements:
 - (1) AC power wiring shall be 12 AWG unless otherwise noted.
 - (2) Wiring internal to control panels shall be insulated with not less than 600 volts, 19 strand No.14 AWG, 90°C MTW, Class C stranded or THHN/THWN approved as 90°C MTW for power circuits connecting to field devices i.e., pushbuttons and relay contacts.
 - (3) No. 16 AWG wiring shall be used for inter-connecting relay coils, contacts, indicator lights etc. within the panels.
 - (4) Wires for analog signal circuits shall be 300-volt stranded copper and shall be twisted shielded pairs not smaller than No. 18 AWG and be separated at least 6 inches from any power wiring.

- (5) Wiring shall be numbered and tagged at each termination. Heat shrunk wire markers shall be provided at each wire termination point internal and external to each panel(s). Wire tags shall be marked with legible machine printed markings and numbers. Adhesive or taped on tags will not be accepted. Each wire shall have a unique tag number assigned and be clearly identified on the approved shop drawings. Tagging scheme shall identify the designated component tag and terminal number destination.
- (6) Wiring for special signals such as communications, digital data, and multiplexed signals shall use manufacturer's standard cables.
- (7) All wires to internal components shall be connected to the "inside" of the field interface terminal strip. All wires to external components shall be connected to the "outside" of the field interface terminal strip. No more than two wires shall be connected to any one terminal point.
- (8) All panel wiring not run in wire ducts shall be bundled and tied.
- (9) Wiring shall not be spliced or tapped except at device terminals or terminal blocks.
- (10) Control and signal wiring shall be restrained by plastic ties or ducts. Hinge wiring shall be secured at each end so that any bending or twisting will be around the longitudinal axis of the wire and the bend area shall be protected with a sleeve.
- (11) Where panel components are provided for future equipment, wiring from the components to the panel terminal blocks shall be provided.
- (12) Wire Color Coding

- (a) Power Wiring: Phase A shall be black with brown phasing tape, Phase B black with orange tape, and Phase C black with yellow tape.
- (b) Internally powered AC Control Wiring: Control panel wiring associated with control circuits that are de-energized when the main panel disconnect is opened shall be color coded "Red".
- (c) Externally powered AC Control Wiring: Control panel wiring associated with control circuits that remain "Hot" when the main panel disconnect is opened shall be color coded "Yellow".
- (d) All yellow wiring leaving panels shall be brought to an isolated set of terminal blocks.
- (e) Low voltage, DC Wiring: Blue (B+); Blue with-tracer (B-).
- (f) DC Control Wiring: Orange
- (g) Neutral: White

Exception: Where prefabricated wire bundles are used, it is permissible to identify the neutral at every termination with a white shrink tube at least 12 inches long.
- (h) Ground: Green
- (i) Field interface wiring shall be black and white pairs unless otherwise noted or required by the National Electrical Code.
- (j) Intrinsically safe Light Blue
- (k) 24 V AC power wire shall be orange and brown.

(13) Wire Duct

- (a) Panel wire duct shall be provided between each row of components and adjacent to each terminal strip. Wire ducts shall be a minimum of one inch wide and three inches deep with removable snap-on covers and perforated walls for easy wire entrance. Wire ducts shall be constructed of non-metallic materials with a voltage insulation in excess of the maximum voltage carried therein.
 - (b) Empty panel wire duct shall be provided for all field connections to the terminal blocks.
 - (c) A minimum of two inches shall be provided between wire duct and terminal block assemblies
 - (d) Wiring duct shall not be filled to more than 60% visible fill.
- g. Wiring Interface: Wiring entering or leaving each panel, console, rack or cabinet shall be terminated and identified as follows:
- (1) Analog and discrete signal wiring shall be terminated at numbered terminal blocks with wire tagged equal to the PLC address.
 - (2) Wiring for special signals such as communications, digital data, and multiplexed signals may be terminated at manufacturer's standard connectors.
- h. Terminal Blocks: Terminal blocks for panels, consoles, racks, and cabinets shall meet the following requirements:
- (1) All terminal blocks shall be 600-volt rated and shall be provided for termination of all circuits entering or leaving all panels. Terminal blocks shall have screw clamp compression, dead front barriers with current bar providing direct contact with wire

between the compression screw and yoke. Yoke, current bar, and clamping screw shall be constructed of high strength and high conductivity metal. Yoke assembly shall guide all strands of wire into the terminal. Current bar shall provide dependable vibration-proof connections. Terminals shall be constructed to allow connection of wires without any special preparation other than stripping. Individual terminals shall be rail mounted to create a complete assembly such that jumpers can be installed with no loss of space on terminal or rail.

- (2) Terminal block components shall be sized to allow insertion of all necessary wire sizes and types. Legible, factory machine printed markings and numbers shall be provided for terminal block identifications on both the inside and outside tracks of the terminal block assembly. Terminal blocks shall be numbered in numerical order. Multiple row of termination blocks shall allow the removal of wire without disturbing other landed wiring.
 - (3) Sufficient terminal blocks shall be provided to terminate all wires routed to the panel, all spare annunciator points and spare conductors. In addition, the greater of 20 percent or four unused spare terminals shall be provided.
 - (4) All connections for future functions shall be wired to numbered terminal blocks, grouped separate from the terminal blocks in use. Terminal blocks shall be grouped to keep 120 V AC circuits separate from the 24 V DC circuits.
 - (5) Terminal blocks shall be CSA certified and UL approved.
- i. Grounding: Panels, consoles, racks and cabinets shall be provided with an isolated copper grounding bus for all signal and shield ground connections. This ground bus shall be grounded at a common signal ground point. The signal grounding system shall meet National Electrical Code requirements.

- (1) Each analog loop shall be grounded at a single point for the loop. This single point shall be at location of the dc power supply for the loop.
 - (2) Each analog loop shall have its wire shields connected to ground at a single point for the loop. Shields shall be grouped and connected to ground at the same point as the analog signal ground.
- j. Analog Signal Isolators: Instruments on different panels, cabinets, or enclosures shall not be wired in series. Provide analog signal isolators for analog signals that are sent from one panel or cabinet to another.
- k. Chemical Feed Pump SCR Controllers:
- (1) Each SCR Controller shall be a completely solid state unit consisting of an electronic switching amplifier, SCR full wave rectifier and associated circuitry.
 - (2) SCR units shall be heavy duty type to handle full current rating of motor and brief acceleration currents.
 - (3) SCR's shall be mounted on heat sinks but electrically isolated therefrom; circuitry shall operate properly over a room temperature range from 50°F to 120°F. All units shall be individually fused.
 - (4) Each controller shall be furnished with a tachometer feedback speed meter.
 - (5) All SCR Controllers shall have provisions for accepting a remote 4-20 ma current control signal.
 - (6) All components used for the control of the feed pump speed shall be located within the control panel.

END OF SECTION

SECTION 26 30 00

ELECTRIC MOTOR ACTUATORS

PART 1 -- GENERAL

1.01 General Specifications

- A. The actuators shall be suitable for use on existing power supply and are to incorporate motor, integral reversing starter, local control facilities and terminals for remote control and indication connections housed within a self contained, sealed enclosure.
- B. As a minimum the actuators should meet the requirements set out in EN15714-2 and ISA SP96.02
- C. In order to maintain the integrity of the enclosure, setting of the torque levels, position limits and configuration of the indication contacts etc. shall be carried out without the removal of any actuator covers and without mains power providing the option of Infra red or Bluetooth® wireless interface. Sufficient commissioning tools shall be provided with the actuators and must meet the enclosure protection and certification levels of the actuators. Commissioning tools shall not form an integral part of the actuator and must be removable for secure storage / authorized release. In addition, provision shall be made for the protection of configured actuator settings by a means independent of access to the commissioning tool. Provision shall be made to disable Bluetooth® communications or only allow a Bluetooth® connection initiated by an Infra-Red command for maximum security.
- D. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel irrespective of the connection sequence of the power supply.

1.02 Actuator Sizing

- A. The actuator shall be sized to guarantee valve closure at the specified differential pressure and temperature. The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal. For linear operating valves, the operating speed shall be such as to give valve closing and opening at approximately 10-12 inches per minute

unless otherwise stated in the data sheet. For 90° valve types the operating time will be specified.

1.03 Environmental

- A. Actuators shall be suitable for indoor and outdoor use. The actuator shall be capable of functioning in an ambient temperature ranging from -33°C (22°F) to 70°C (140°F), up to 100% relative humidity.
- B. Actuators for hazardous area applications shall meet the area classification, gas group and surface temperature requirements specified in data sheet.

1.04 Enclosure

- A. Actuators shall be o-ring sealed, watertight to IP66/IP68 21feet for 72hrs, NEMA 4, 6. The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust when the terminal cover is removed for site for cabling, the terminal compartment having the same ingress protection rating as the actuator with the terminal cover removed.
- B. Enclosure must allow for temporary site storage without the need for electrical supply connection.
- C. All external fasteners shall be plated stainless steel. The use of un-plated stainless steel or steel fasteners is not permitted.

1.05 Motor

- A. The motor shall an integral part of the actuator, designed specifically for valve actuator applications. It shall be a low inertia high torque design, class F insulated with a class B temperature rise giving a time rating of 15 minutes at 40°C (104°F) at an average load of at least 33% of maximum valve torque. Temperature shall be limited by 2 thermostats embedded in the motor end windings and integrated into its control.
- B. Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gearcase.
- C. Motor Protection
 - 1. Protection shall be provided for the motor as follows:
 - 2. Stall - the motor shall be de-energized within 8 seconds in the event of a stall when attempting to unseat a jammed valve.

3. Over temperature - thermostat will cause tripping of the motor. Auto-reset on cooling
4. Single phasing - lost phase protection.
5. Direction – phase rotation correction.

1.06 Gearing

- A. The actuator gearing shall be totally enclosed in an oil-filled gearcase suitable for operation at any angle. Grease lubrication is not permissible. All drive gearing and components must be of metal construction and incorporate a lost-motion hammerblow feature. For rising spindle valves the output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the ball or roller type at the base of the actuator. The design should be such as to permit the opening of the gearcase for inspection or disassembled without releasing the stem thrust or taking the valve out of service. For 90° operating type of valves drive gearing shall be self locking to prevent the valve back-driving the actuator.

1.07 Hand Operation

- A. A handwheel shall be provided for emergency operation, engaged when the motor is declutched by a lever or similar means, the drive being restored to electrical operation automatically by starting the motor. The handwheel or selection lever shall not move on restoration of motor drive. Provision shall be made for the hand/auto selection lever to be locked in both hand and auto positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in hand without damage to the drive train.
- B. Clockwise operation of the handwheel shall give closing movement of the valve unless otherwise stated in the data sheet. For linear valve types the actuator handwheel drive must be mechanically independent of the motor drive and should be such as to permit valve operation in a reasonable time with a manual force not exceeding 400N through stroke and 800N for seating/unseating of the valve.

1.08 Drive Interface

- A. The actuator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. The drive bush shall be positioned in a detachable base of the actuator. Thrust bearings shall be

sealed for life and the base shall be capable of withstanding five times the rated thrust of the actuator.

1.09 Local Controls

- A. The actuator shall incorporate local controls for Open, Close and Stop and a Local/Stop/Remote mode selector switch lockable in any one of the following three positions: local control only, stop (no electrical operation), remote control plus local stop only. It shall be possible to select maintained or non-maintained local control.
- B. The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.
- C. The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

1.010 Torque and Limits

- A. Torque and turns limitation to be adjustable as follows:
- B. Position setting range – multi-turn: 2.5 to 8,000 turns, with resolution to 7.5 deg. of actuator output.
- C. Position setting range – direct drive part turn actuators: 90° +/-10°, with resolution to 0.1 deg. of actuator output.
- D. Torque setting: 40% to 100% rated torque.
- E. Position measurement – Absolute position measurement should be incorporated within the actuator. The technology must be capable of reliably measuring position even in the case of a single fault. The design must be simple with the minimum amount of moving parts (no more than 5). Technologies such as LEDs or potentiometers for position measurement are considered unreliable and therefore not preferred.
- F. Measurement of torque shall be from direct measurement of force at the output of the actuator. Methods of determining torque-using data derived from the motor such as motor speed, current, flux etc are not acceptable
- G. A means for automatic “torque switch bypass” to inhibit torque off during valve unseating and “latching” to prevent torque switch hammer under maintained or repeated control signals shall be provided.
- H. The electrical circuit diagram of the actuator should not vary with valve type remaining identical regardless of whether the valve is to open or close on torque or position limit.

1.011 Remote Valve Position and Status Indication

- A. Four contacts shall be provided which can be selected to indicate any position of the valve; Provision shall be made for the selection of a normally closed or open contact form. Contacts shall maintain and update position indication during handwheel operation when all external power to the actuator is isolated.
- B. The contacts shall be rated for 5mA to 5A, 120V AC, 30V DC.
- C. As an alternative to providing valve position indication any of the four above contacts shall be selectable to signal one of the following:
 - 1. Valve opening, closing or moving
 - 2. Thermostat tripped, lost phase
 - 3. Motor tripped on torque in mid travel, motor stalled
 - 4. Remote selected
 - 5. Actuator being operated by handwheel
 - 6. Actuator fault
- D. Provision shall be made in the design for an additional eight contacts having the same functionality.
- E. A configurable monitor relay shall be provided as standard, which can be used to indicate either Availability or Fault. The relay should be a spring return type with a Normally Open / Normally Closed contact pre-wired to the terminal bung.
- F. The Monitor (availability or fault) relay, being energized from the control transformer will de-energize under any one or more the following conditions:
 - 1. Available Mode
 - 2. Loss of main or customer 24V DC power supply
 - 3. Actuator control selected to local or stop
 - 4. Motor thermostat tripped
 - 5. Actuator internal fault
 - 6. Loss of main or customer 24V DC power supply
 - 7. Motor thermostat tripped
 - 8. Actuator internal fault
- G. Provision shall be made in the design for the addition of a contactless transmitter to give a 4-20mA analogue signal corresponding to valve travel and / or torque for remote indication when required. The transmitter will auto range to the set limits

H. Local Position Indication

1. The actuator display shall include a dedicated numeric/symbol digital position indicator displaying valve position from fully open to fully close in 0.1% increments. Valve closed and open positions shall be indicated by symbols showing valve position in relation to the pipework to ensure that valve status is clearly interpreted. With mains power connected, the display shall be backlit to enhance contrast at all ambient light levels and shall be legible from a distance of at least 5m (16ft).
2. Red, green, and yellow LEDs corresponding to open, closed and intermediate valve positions shall be included on the actuator display when power is switched on. The yellow LED should also be fully programmable for on/off, blinker and fault indication. The digital display shall be maintained and updated during handwheel operation when mains power to the actuator is isolated. In the event of a (main) power (supply) loss or failure, the position contacts must continue to be able to supply remote position feedback and maintain interlock capabilities. If batteries are required to maintain contact functionality the actuator vendor shall provide a supply sufficient for 45 continuous days of un-powered operation with one complete valve cycle every hour
3. The actuator display shall include a fully configurable dot-matrix display element with a minimum pixel resolution of 168 x 132 to display operational, alarm, configuration and graphical datalogger information. The text display shall be selectable between English and other languages such as: Spanish, German, French, and Italian. Provision shall be made to upload a different language without removal of any covers or using specialized tools not provided as standard with the actuator.

I. Datalogger graphical displays should as a minimum be able to display log and trend graphs on the local LCD for the following:

1. Torque versus Position
2. Number of Starts versus Position
3. Number of starts per hour
4. Dwell Time
5. Average temperature

J. The main display shall be capable of indicating 4 different home-screens of the following configuration:

1. Position and status
2. Position and torque (analogue)
3. Position and torque (digital)
4. Position and demand (positioning)

- K. Provision shall be made for the addition of an optional environmental cover to protect the display from high levels of UV radiation or abrasive materials.
- L. The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.
- M. Actuators that are not accessible shall have the capability of a “mirror image” of the face of the actuator Remote Hand Station. (RHS) shall be suitable for remote connection to an electric actuator up to 100m distance, include local control facilities, a backlit LCD display and terminals for communication highway connection to the host actuator housed within a self-contained, double-sealed enclosure. In order to maintain the integrity of the enclosure, setting of the actuator torque levels, position limits and configuration of the indication contacts etc. shall be carried out without the removal of any covers via a Bluetooth® wireless interface.

1.012 Integral Starter and Transformer

- A. The reversing starter, control transformer and local controls shall be integral with the valve actuator, suitably housed to prevent breathing and condensation. The starter shall be suitable for 60 starts per hour and of rating appropriate to motor size. The controls supply transformer shall be fed from two of the incoming three phases and incorporate overload protection. It shall have the necessary tapping and be adequately rated to provide power for the following functions:
 - 1. Energizing of the contactor coils.
 - 2. 24V DC or 110V AC output for remote controls (maximum 5W/VA)
 - 3. Supply for all the internal electrical circuits.

1.013 Remote Control Facilities

- A. The necessary control, wiring and terminals shall be provided integral to the actuator enclosure. Open and close external interlocks shall be made available to inhibit local and remote valve opening / closing control. It shall be possible to configure the interlocks to be active in remote control only.
- B. Remote control signals fed from an internal 24V DC (or 110VAC) supply and/or from an external supply between 20V and 60 VDC or 40V and 120VAC, to be suitable for any one or more of the following methods of control:
 - 1. Open, Close and Stop control.
 - 2. Open and Close maintained or “push to run” (inching) control.

3. Overriding Emergency Shut-down to close (or open) valve from a normally closed or open contact.
 4. Two-wire control, energize to close (or open), de-energize to open (or close).
- C. Additionally provision shall be made for a separate 'drive enable' input to prevent any unwanted electrical operation.
- D. It shall be possible to reverse valve travel without the necessity of stopping the actuator. The motor starter shall be protected from excessive current surges during rapid travel reversal. The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 2kV.

1.014 Monitoring Facilities

- A. Facilities shall be provided for monitoring actuator operation and availability as follows:
1. Actuator text display indication of the following status/alarms:
 2. Closed Limit, open limit, moving open, moving closed, stopped
 3. Torque trip closing, torque trip opening, stalled
 4. ESD active, interlock active
 5. Thermostat trip, phase lost, 24V supply lost, Local control failure
 6. Configuration error, Position sensor failure, Torque sensor failure
 7. Battery low, power loss inhibit
- B. Integral datalogger to record and store the following operational data:
1. Opening last /average torque against position
 2. Closing last /average torque against position
 3. Opening motor starts against position
 4. Closing motor starts against position
 5. Total open/closed operations
 6. Maximum recorded opening and closing torque values
 7. Event recorder logging operational conditions (valve, control and actuator)
- C. The datalogger shall record relevant time and date information for stored data.
- D. Datalogger data shall be accessed via non-intrusive Bluetooth® communication and data displayed on the local LCD. Sufficient standard intrinsically safe tools shall be provided for downloading datalogger and actuator configuration files from the actuators and subsequent uploading to a

PC. The actuator manufacturer shall supply PC software to enable datalogger files to be viewed and analyzed.

1.015 Wiring and Termination

- A. Internal wiring shall be tropical grade PVC insulated stranded cable of appropriate size for the control and 3-phase power. Each wire shall be clearly identified at each end. The terminals shall be embedded in a terminal block of high tracking resistance compound.
- B. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal and shall be provided with a minimum of 3 threaded cable entries with provision for an additional 5 extra conduit entries.
- C. All wiring supplied as part of the actuator to be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable.
- D. A durable terminal identification card showing a plan of terminals shall be provided attached to the inside of the terminal box cover indicating:
 - 1. Serial number
 - 2. External voltage values
 - 3. Wiring diagram number
 - 4. Terminal layout
 - 5. The code card shall be suitable for the contractor to inscribe cable core identification alongside terminal numbers.

1.016 Commissioning Kit

- A. Each actuator shall be supplied with a start-up kit comprising installation instruction manual, electrical wiring diagram and cover seals to make good any site losses during the commissioning period. In addition, sufficient actuator commissioning tools shall be supplied to enable actuator set up and adjustment during valve/actuator testing and site installation commissioning.

1.017 Performance and Test Certificate

- A. Each actuator must be performance tested and individual test certificates shall be supplied free of charge. The test equipment should simulate a typical valve load, and the following parameters should be recorded.

1. Current at maximum torque setting
2. Torque at max. torque setting
3. Flash test voltage
4. Actuator output speed or operating time.

B. In addition, the test certificate should record details of specification such as gear ratios for both manual and automatic and second stage gearing if provided, drive closing direction, wiring diagram number.

1.018 On Site Start Up Assistance:

A. Prior to start up, contractor shall inform service techs of all requirements of the certificate of proper installation. All forms and documentation required for the certificate of proper installation shall be given to service tech prior to start up. Minimum of 1 day per two actuators. Start-up shall be performed by direct factory tech that resides in Florida.

1.019 WARRANTY:

A. Each actuator shall be warranted for a minimum of 24 months of operation up to a maximum of 36 months from shipment.

1.020 Acceptable Electric Motor Actuator Manufacturer:

A. Rotork Controls IQT Series (Open/Close).

1.021 Supplier:

A. Fluid Control Specialties
111 Maritime Dr.
Sanford, FL 32771
407.302.5611
Beau.Colton@fc-spec.com

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for clearing of all areas within the Contract limits and other areas shown, including work designated in permits and other agreements, in accordance with the requirements of Division 1.
- B. Related Work Specified in Other Sections Includes:
 - 1. Section 02 40 00 - Demolition
 - 2. Section 31 23 16 - Excavation - Earth and Rock
 - 3. Section 31 23 23 - Backfilling
 - 4. Section 32 92 00 – Lawn Restoration

1.2 DEFINITIONS

- A. Clearing: Clearing is the removal from the ground surface and disposal, within the designated areas, of trees, brush, shrubs, down timber, decayed wood, other vegetation, rubbish and debris as well as the removal of fences.
- B. Grubbing: Grubbing is the removal and disposal of all stumps, buried logs, roots larger than 1-1/2 inches, matted roots and organic materials.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TREE REMOVAL

- A. No trees shall be removed.

3.2 TREES AND SHRUBS TO BE SAVED

- A. Protection: Protect all trees and shrubs within the construction site from defacement, injury and destruction.

1. Work within the limits of the tree drip line with extreme care using either hand tools or equipment that will not cause damage to trees.
 - a. Do not disturb or cut roots unnecessarily. Do not cut roots 1-1/2 inches and larger unless approved.
 - b. Immediately backfill around tree roots after completion of construction in the vicinity of trees.
 - c. Do not operate any wheeled or tracked equipment within drip line.
2. Protect vegetation from damage caused by emissions from engine-powered equipment.
3. During working operations, protect the trunk, foliage and root system of all trees to be saved with boards or other guards placed as shown and as required to prevent damage, injury and defacement.
 - a. Do not pile excavated materials within the drip line or adjacent to the trunk of trees.
 - b. Do not allow runoff to accumulate around trunk of trees.
 - c. Do not fasten or attach ropes, cables, or guy wires to trees without permission. When such permission is granted, protect the tree before making fastening or attachments by providing burlap wrapping and softwood cleats.
 - d. The use of axes or climbing spurs for trimming will not be permitted.
 - e. Provide climbing ropes during trimming.
4. Remove shrubs to be saved, taking a sufficient earth ball with the roots to maintain the shrub.
 - a. Temporarily replant if required and replace at the completion of construction in a condition equaling that which existed prior to removal.
 - b. Replace in kind if the transplant fails.
5. Have any tree and shrub repair performed by a tree surgeon properly licensed by the State of Florida and within 24 hours after damage occurred.

3.3 CLEARING AND GRUBBING

- A. Clearing: Clear all items specified to the limits shown and remove cleared and grubbed materials from the site.
 - 1. Do not start earthwork operations in areas where clearing and grubbing is not complete, except that stumps and large roots may be removed concurrent with excavation.
 - 2. Comply with erosion, sediment control and storm management measures as specified in Division 1.
- B. Grubbing: Clear and grub areas to be excavated, areas receiving less than 3 feet of fill and areas upon which structures are to be constructed.
 - 1. Remove stumps and root mats in these areas to a depth of not less than 18 inches below the subgrade of sloped surfaces.
 - 2. Fill all depressions made by the removal of stumps or roots with material suitable for backfill as specified in Section 31 23 23.
- C. Limited Clearing: Clear areas receiving more than 3 feet of fill by cutting trees and shrubs as close as practical to the existing ground. Grubbing will not be required.
- D. Dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved dump. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor; the cost of which shall be included in the prices bid for the various classes of work.

3.4 TOPSOIL

- A. Stripping: Strip existing topsoil from areas that will be excavated or graded prior to commencement of excavating or grading and place in well-drained stockpiles in approved locations.

3.5 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

- A. The CONTRACTOR shall exercise extreme care to avoid unnecessary disturbance of developed private property along the route of the construction. Trees, shrubbery, gardens, lawns, and other landscaping, which in the opinion of the ENGINEER must be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.

- B. All soil preservation procedures and replanting operations shall be under the supervision of a nursery representative experienced in such operations.
- C. Improvements to the land such as fences, walls, outbuildings, and other structures which of necessity must be removed, shall be replaced with equal quality materials and workmanship.
- D. Clean up the construction site across developed private property directly after construction is completed upon approval of the ENGINEER.
- E. Any commercial signs, disturbed or removed, shall be restored to their original condition within 24 hours.

3.6 PRESERVATION OF PUBLIC PROPERTY

- A. The appropriate paragraphs of Article 3.5 of these Specifications shall apply to the preservation and restoration of public lands, parks, rights-of-way, easements, and all other damaged areas.

END OF SECTION

SECTION 31 23 16

EXCAVATION - EARTH AND ROCK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for performing opencut excavations to the widths and depths necessary for constructing structures, pipelines and conduits including excavation of any material necessary for any purpose pertinent to the construction of the Work.
- B. Related Work Specified in Other Sections Includes:
 - 1. Section 31 10 00 - Site Clearing
 - 2. Section 31 40 00 - Shoring, Sheeting and Bracing
 - 3. Section 31 23 23 - Backfilling

1.2 DEFINITIONS

- A. Earth: "Earth" includes all materials which, in the opinion of the ENGINEER, do not require blasting, barring, wedging or special impact tools for their removal from their original beds, and removal of which can be completed using standard excavating equipment. Specifically excluded are all ledge and bedrock and boulders or pieces of masonry larger than one cubic yard in volume.
- B. Rock: "Rock" includes all materials which, in the opinion of the ENGINEER, require blasting, barring, wedging and/or special impact tools such as jack hammers, sledges, chisels, or similar devices specifically designed for use in cutting or breaking rock for removal from their original beds and which have compressive strengths in their natural undisturbed state in excess of 300 psi. Boulders or masonry larger than one cubic yard in volume are classed as rock excavation.

1.3 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. Dewatering Excavation Plan: Develop an excavation dewatering plan that considers site ground and groundwater conditions, the type and arrangement of the equipment to be used and the proper method of groundwater disposal. Prepare the dewatering plan before beginning excavations below groundwater. Maintain one copy of the dewatering plan at the project site to be available for inspection while all dewatering operations are underway.

1.4 SITE CONDITIONS

- A. Geotechnical Investigation: A geotechnical investigation and report was prepared by Ardaman & Associates, Inc. and was intended only for use by the OWNER and ENGINEER in preparing the Contract Documents.
 - 1. The geotechnical investigation report may be examined for what ever value it may be considered to be worth. However, this information is not guaranteed as to its accuracy or completeness.
 - 2. The geotechnical investigation report is not part of the Contract Documents.
- B. Actual Conditions: Make any geotechnical investigations deemed necessary to determine actual site conditions.
- C. Underground Utilities: Locate and identify all existing underground utilities prior to the commencement of Work.
- D. Quality and Quantity: Make any other investigations and determinations necessary to determine the quality and quantities of earth and rock and the methods to be used to excavate these materials.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL

- A. Clearing: Clear opencut excavation sites of obstructions preparatory to excavation. Clearing in accordance with Section 31 10 00, includes removal and disposal of vegetation, trees, stumps, roots and bushes, except those specified to be protected during trench excavation.
- B. Banks: Shore or slope banks to the angle of repose to prevent slides or cave-ins in accordance with Section 31 40 00.
- C. Safety: Whenever an excavation site or trench is left unattended by the CONTRACTOR or when an area is not within 100 feet of observation by the CONTRACTOR, the excavation site or trench shall be filled and/or, at the OWNER's discretion, protected by other means to prevent accidental or unauthorized entry. Such protection shall include barricades and other protection devices requested by the ENGINEER or OWNER, including temporary fencing,

snow fencing, or temporary "structure" tape. Such safety items shall not relieve the CONTRACTOR of any site safety requirements or liabilities established by Federal, State and local laws and agencies, including OSHA, but is intended as additional safety measures to protect the general public.

- D. Hazardous Materials: If encountered, take care of hazardous materials not specifically shown or noted in accordance with Section 01 57 00.
- E. During excavation and any site work, storm water pollution prevention measures shall be taken to ensure that water quality criteria are not violated in the receiving water body and all state and local regulatory requirements are met.

3.2 STRUCTURE EXCAVATION

- A. Excavation Size: Provide excavations of sufficient size and only of sufficient size to permit the Work to be economically and properly constructed in the manner and of the size specified.
- B. Excavation Shape: Shape and dimension the bottom of the excavation in earth or rock to the shape and dimensions of the underside of the structure or drainage blanket wherever the nature of the excavated material permits.
- C. Compaction: Before placing foundation slabs, footings or backfill, proof roll the bottom of the excavations to detect soft spots.
 - 1. For accessible areas, proof roll with a ten-wheel tandem axle dump truck loaded to at least 15 tons or similarly loaded construction equipment.
 - 2. For small areas, proof roll with a smooth-faced steel roller filled with water or sand, or compact with a mechanical tamper.
 - 3. Make one complete coverage, with overlap, of the area.
 - 4. Overexcavate soft zones and replace with compacted select fill in accordance with Part 3, Section 3.9.

3.3 TRENCH EXCAVATION

- A. Preparation: Properly brace and protect trees, shrubs, poles and other structures which are to be preserved. Unless shown or specified otherwise, preserve all trees and large shrubs. Hold damage to the root structure to a minimum. Small shrubs may be preserved or replaced with equivalent specimens.
- B. Adequate Space: Keep the width of trenches to a minimum, however, provide adequate space for workers to place, joint and backfill the pipe properly.

1. The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8-inches for unsheeted trench or 12 inches for sheeted trench.

The maximum width of trench, measured at the top of the pipe, shall not exceed the outside pipe diameter plus 2 feet, unless otherwise shown on the drawing details or approved by the ENGINEER. Trench walls shall be maintained vertical from the bottom of the trench to a line measured one foot above the top of the pipe. From one foot above the top of the pipe to the surface the trench walls shall conform with OSHA Regulations.

2. In sheeted trenches, measure the clear width of the trench at the level of the top of the pipe to the inside of the sheeting.
3. Should the maximum trench widths specified above be exceeded without written approval, provide concrete cradle or encasement for the pipe as directed. No separate payment will be made for such concrete cradle or encasement.

C. Depth:

1. Excavate trenches to a minimum depth of 8 inches below the bottom of the pipe or the bottom of encasement for electrical ducts, unless otherwise shown, specified or directed, so that bedding material can be placed in the bottom of the trench and shaped to provide a continuous, firm bearing for duct encasement, pipe barrels and bells.
2. Standard trench grade shall be defined as the bottom surface of the utility to be constructed or placed within the trench. Trench grade for utilities in rock or other non-cushioning material shall be defined as additional undercuts backfilled with #57 stone compacted in 6-inch lifts, below the standard 8-inches minimum trench undercut. Excavation below trench grade that is not ordered in writing by the ENGINEER shall be backfilled to trench grade and compacted.

D. Unstable or Unsuitable Materials: If unstable or unsuitable material is exposed at the level of the bottom of the trench excavation, excavate the material in accordance with the subsection headed "Authorized Additional Excavation".

1. Material shall be removed for the full width of the trench and to the depth required to reach suitable foundation material.
2. When in the judgment of the ENGINEER the unstable or unsuitable material extends to an excessive depth, the ENGINEER may advise, in writing, the need for stabilization of the trench bottom with additional select fill material,

crushed stone, washed shell, gravel mat or the need to provide firm support for the pipe or electrical duct by other suitable methods.

3. Crushed stone, washed shell and gravel shall be as specified in Section 31 23 23.
 4. Payment for such trench stabilization will be made under the appropriate Contract Items or where no such items exist, as a change in the Work.
- E. Length of Excavation: Keep the open excavated trench preceding the pipe or electrical duct laying operation and the unfilled trench, with pipe or duct in place, to a minimum length which causes the least disturbance. Provide ladders for a means of exit from the trench as required by applicable safety and health regulations.
- F. Excavated Material: Excavated material to be used for backfill shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall be responsible for obtaining the sites to be used and shall maintain his operations to provide for natural drainage and not present an unsightly appearance.
- G. Water: Allow no water to rise in the trench excavation until sufficient backfill has been placed to prevent pipe or duct flotation.

3.4 SHORT TUNNEL EXCAVATION

- A. Short Tunnel Requirements: In some instances, trees, shrubs, utilities, sidewalks and other obstructions may be encountered, the proximity of which may be a hindrance to open-cut trench excavation. In such cases, excavate by means of short tunnels in order to protect such obstructions against damage.
1. Construct the short tunnel by hand, auger or other approved method approximately 6 inches larger than the diameter of pipe bells or outer electrical duct encasement.
 2. Consider such short tunnel work incidental to the construction of pipelines or conduits and all appurtenances. The need for short tunnels will not be grounds for additional payment.

3.5 EXCAVATION FOR JACKING AND AUGERING

- A. Jacking and Augering Requirements: Allow adequate length in jacking pits to provide room for the jacking frame, the jacking head, the reaction blocks, the jacks, auger rig, and the jacking pipe. Provide sufficient pit width to allow ample working space on each side of the jacking frame. Allow sufficient pit depth such

that the invert of the pipe, when placed on the guide frame, will be at the elevation desired for the completed line. Tightly sheet the pit and keep it dry at all times.

3.6 ROCK EXCAVATION

- A. Rock Excavation: Excavate rock within the boundary lines and grades as shown, specified or required.
 - 1. Rock removed from the excavation becomes the property of the CONTRACTOR. Transport and dispose of excavated rock at an off-site disposal location. Obtain the off-site disposal location.
 - 2. Remove all shattered rock and loose pieces.
- B. Structure Depths: For cast-in-place structures, excavate the rock only to the bottom of the structure, foundation slab, or drainage blanket.
- C. Trench Width: Maintain a minimum clear width of the trench at the level of the top of the pipe of the outside diameter of the pipe barrel plus 4 feet, unless otherwise approved.
- D. Trench Depth: For trench excavation in which pipelines or electrical ducts are to be placed, excavate the rock to a minimum depth of 8 inches below the bottom of the pipe or duct encasement. Provide a cushion of sand or suitable crushed rock. Refill the excavated space with pipe bedding material in accordance with Section 31 23 23. Include placing, compacting and shaping pipe bedding material in the appropriate Contract Items.
- E. Manhole Depths: For manhole excavation, excavate the rock to a minimum depth of 8 inches below the bottom of the manhole base for pipelines 24 inches in diameter and larger and 6 inches below the bottom manhole base for pipelines less than 24 inches in diameter. Refill the excavated space with pipe bedding material in accordance with Section 31 23 23. Include placing, compacting and shaping pipe bedding material for manhole bases in the appropriate Contract Items.
- F. Over-excavated Space: Refill the excavated space in rock below structures, pipelines, conduits and manholes, which exceeds the specified depths with 2,500 psi concrete, crushed stone, washed shell, or other material as directed. Include refilling of over-excavated space in rock as part of the rock excavation.
- G. Other Requirements: Follow, where applicable, the requirements of the subsections on "Trench Excavation" and "Structure Excavation".
- H. Payment: Rock excavation, including placing, compacting and shaping of the select fill material, will be paid for under the appropriate Contract Items.

- I. Blasting: Not approved.

3.7 FINISHED EXCAVATION

- A. Finish: Provide a reasonably smooth finished surface for all excavations, which is uniformly compacted and free from irregular surface changes.
- B. Finish Methods: Provide a degree of finish which is ordinarily obtainable from blade-grade operations, except as otherwise specified in Section 31 23 23.

3.8 PROTECTION

- A. Traffic and Erosion: Protect newly graded areas from traffic and from erosion.
- B. Repair: Repair any settlement or washing away that may occur from any cause, prior to acceptance. Re-establish grades to the required elevations and slopes.
- C. It shall be the CONTRACTOR's responsibility to acquaint himself with all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. Where actual conflicts are unavoidable, work shall be coordinated with the facility owner and performed so as to cause as little interference as possible with the service rendered by the facility disturbed. Facilities or structures damaged in the prosecution of the work shall be repaired and/or replaced immediately, in conformance with current standard practices of the industry, or according to the direction of the owner of such facility, at the CONTRACTOR's expense.
- D. Other Requirements: Conduct all Work in accordance with the environmental protection requirements specified in Division 1.

3.9 AUTHORIZED ADDITIONAL EXCAVATION

- A. Additional Excavation: Carry the excavation to such additional depth and width as authorized in writing, for the following reasons:
 - 1. In case the materials encountered at the elevations shown are not suitable.
 - 2. In case it is found desirable or necessary to go to an additional depth, or to an additional depth and width.
- B. Refill Materials: Refill such excavated space with either authorized 2500 psi concrete or compacted select fill material, in compliance with the applicable provisions of Section 31 23 23.

- C. **Compaction:** Where necessary, compact fill materials to avoid future settlement. As a minimum, unless otherwise specified or directed, backfill layers shall not exceed 6-inches in thickness for the full trench width and compaction shall equal 95% of maximum density, or 98% if under paved area of roadway, as determined by using ASTM D 1557. Compaction density tests shall be made at all such backfill areas with spacing not to exceed 100 feet apart and on each 6-inch compacted layer.
- D. **Payment:** Additional earth excavations so authorized and concrete or select fill materials authorized for filling such additional excavation and compaction of select fill materials will be paid for under the appropriate Contract Items or where no such items exist, as a change in the Work.

3.10 UNAUTHORIZED EXCAVATION

- A. **Stability:** Refill any excavation carried beyond or below the lines and grades shown, except as specified in the subsection headed "Authorized Additional Excavation", with such material and in such manner as may be approved in order to provide for the stability of the various structures.
- B. **Refill Materials:** Refill spaces beneath all manholes, structures, pipelines, or conduits excavated without authority with 2500 psi concrete or compacted select fill material, as approved.
- C. **Payment:** Refill for unauthorized excavation will not be measured and no payment will be made therefor.

3.11 SEGREGATION STORAGE AND DISPOSAL OF MATERIAL

- A. **Stockpiling Suitable Materials:** Stockpile topsoil suitable for final grading and landscaping and excavated material suitable for backfilling or embankments separately on the site in approved locations.
- B. **Stockpile Locations:** Store excavated and other material a sufficient distance away from the edge of any excavation to prevent its falling or sliding back into the excavation and to prevent collapse of the wall of the excavation. Provide not less than 2 feet clear space between the top of any stockpile and other material and the edge of any excavation.
- C. **Excess Materials:** CONTRACTOR shall be responsible to transport and dispose of surplus excavated material and excavated material unsuitable for backfilling or embankments at an off-site disposal location secured by the CONTRACTOR.

3.12 REMOVAL OF WATER

- A. Water Removal: At all times during the excavation period and until completion and acceptance of the WORK at final inspection, provide ample means and equipment with which to remove promptly and dispose of properly all water entering any excavation or other parts of the WORK.
- B. Dry Excavations: Keep the excavation dry.
- C. Water Contact: Allow no water to rise over or come in contact with masonry and concrete until the concrete and mortar have attained a set and, in any event, not sooner than 12 hours after placing the masonry or concrete.
- D. Discharge of Water: Dispose of water pumped or drained from the Work in a safe and suitable manner without damage to adjacent property or streets or to other work under construction.
- E. Protection: Provide adequate protection for water discharged onto streets. Protect the street surface at the point of discharge.
- F. Sanitary Sewers: Discharge no water into sanitary sewers.
- G. Storm Sewers: Discharge no water containing settleable solids into storm sewers.
- H. Repair: Promptly repair any and all damage caused by dewatering the Work.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 31 23 23

BACKFILLING

PART 1 GENERAL

1.1 SUMMARY

- A. General Requirements: Backfill all excavation to the original surface of the ground or to such other grades as may be shown or required. For areas to be covered by topsoil, leave or stop backfill (12) inches below the finished grade or as shown. Obtain approval for the time elapsing before backfilling against masonry structures. Remove from all backfill, any compressible, putrescible, or destructible rubbish and refuse and all lumber and braces from the excavated space before backfilling is started. Leave sheeting and bracing in place or remove as the work progresses.
- B. Equipment Limitations: Do not permit construction equipment used to backfill to travel against and over cast-in-place concrete structures until the specified concrete strength has been obtained, as verified by concrete test cylinders. In special cases where conditions warrant, the above restriction may be modified providing the concrete has gained sufficient strength, as determined from test cylinders, to satisfy design requirements for the removal of forms and the application of load.
- C. Related Work Specified in Other Sections Includes:
 - 1. Section 31 10 00 - Site Clearing
 - 2. Section 31 23 16 - Excavation – Earth and Rock

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. ASTM D 1557 - Standard Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures Using 10 lb Rammer and 18 in Drop

PART 2 PRODUCTS

2.1 BACKFILL MATERIAL - GENERAL

- A. General: Backfill with sound materials, free from waste, organic matter, rubbish, boggy or other unsuitable materials.

- B. General Materials Requirements: Conform materials used for backfilling to the requirements specified. Follow common fill requirements whenever drainage or select fill is not specified. Determine and obtain the approval of the appropriate test method where more than one compaction test method is specified.
- C. Frozen Materials: Do not use frozen material for backfilling.

2.2 DRAINAGE FILL

- A. Materials for Drainage Fill: Use clean gravel, crushed stone, or other suitable material conforming to the gradation specified for drainage fill. Clay and fine particles are unacceptable in drainage fill. Provide drainage fill of a grade between the following limits:

U.S. Standard Sieve	Percent Passing By Weight
1-1/2 inch	100
1 inch	95-100
1/2 inch	45-65
#4	5-15
#16	0-4

2.3 SELECT FILL

- A. Materials for Select Fill: Use clean gravel, crushed stone, washed shell, or other granular or similar material as approved which can be readily and thoroughly compacted to 95 percent of the maximum dry density obtainable by ASTM D 1557.

- 1. Allowed Materials: Grade select fill between the following limits:

U.S. Standard Sieve	Percent Passing By Weight
2 inch	100
1-1/2 inch	90-100
1 inch	75-95
1/2 inch	45-70
#4	25-50
#10	15-40
#200	5-15

2. Unallowed Materials: Very fine sand, uniformly graded sands and gravels, sand and silt, soft earth, or other materials that have a tendency to flow under pressure when wet are unacceptable as select fill.

2.4 COMMON FILL

- A. Materials for Common Fill: Material from on-site excavation may be used as common fill provided that it can be readily compacted to 90 percent of the maximum dry density obtainable by ASTM D 1557 and does not contain unsuitable material. Select fill may be used as common fill at no change in the Contract Price.
- B. Granular Materials On-Site: Granular on-site material, which is fairly well graded between the following limits may be used as granular common fill:

U.S. Standard Sieve	Percent Passing by Weight
3 inch	100
#10	50-100
#60	20-90
#200	0-20

- C. Cohesive Materials On-Site: Cohesive site material may be used as common fill.
 1. The gradation requirements do not apply to cohesive common fill.
 2. Use material having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.
- D. Material Approval: All material used as common fill is subject to approval. If there is insufficient on-site material, import whatever additional off-site material is required which conforms to the specifications and at no additional cost.

2.5 UTILITY PIPE BEDDING

- A. Class A (special utility bedding). Should special bedding be required due to depth of cover, impact loadings or other conditions, Class A bedding shall be installed, as shown in Section 6 of the Lee County Utilities Operations Manual.
- B. Class B (minimum utility bedding). The bottom of the trench shall be shaped to provide a firm bedding for the utility pipe. The utility shall be firmly bedded in

undisturbed firm soil or hand shaped unyielding material. The bedding shall be shaped so that the pipe will be in continuous contact therewith for its full length and shall provide a minimum bottom segment support for the pipe equal to 0.3 times the outside diameter of the barrel.

PART 3 EXECUTION

3.1 ELECTRICAL DUCT AND PRECAST STRUCTURE BEDDING

- A. Bedding Compaction: Bed all electrical ducts and precast structures in well graded, compacted, select fill conforming to the requirements except as otherwise shown, specified, or required. Extend electrical duct bedding a minimum of 6 inches below the bottom of the duct encasement for the full trench width. Compact bedding thickness no less than 6 inches for precast concrete manhole bases.
- B. Concrete Work Mats: Cast cast-in-place structure bases and other foundations for structures against a 2500 psi concrete work mat in clean and dry excavations, unless otherwise shown, specified or required.
- C. Bedding Placement: Place select fill used for bedding beneath electrical ducts and precast structure bases, in uniform layers not greater than 9 inches in loose thickness. Thoroughly compact in place with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.
- D. Use of Select Fill: Bed existing underground structures, tunnels, conduits and pipes crossing the excavation with compacted select fill material. Place bedding material under and around each existing underground structure, tunnel, conduit or pipe and extend underneath and on each side to a distance equal to the depth of the trench below the structure, tunnel, conduit or pipe.

3.2 PIPE BEDDING AND INITIAL BACKFILL

- A. Hand Placement: Place select fill by hand for initial pipe backfill from top of bedding to 1 foot over top of pipes in uniform layers not greater than 6 inches in loose thickness. Tamp under pipe haunches and thoroughly compact in place the select fill with suitable mechanical or pneumatic tools to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.
- B. Stone Placement: Do not place large stone fragments in the pipe bedding or backfill to 1 foot over the top of pipes, nor nearer than 2 feet at any point from any pipe, conduit or concrete wall.

- C. Unallowed Materials: Pipe bedding containing very fine sand, uniformly graded sands and gravels, sand and silt, soft earth, or other materials that have a tendency to flow under pressure when wet is unacceptable.

3.3 BEDDING PLACEMENT AND BACKFILL FOR PIPE IN SHORT TUNNEL

- A. Bed pipelines or electrical ducts placed in short tunnels in select fill or 2500 psi concrete. Completely fill the remainder of the annular space between the outside of the pipe wall and the tunnel wall with select fill, suitable job-excavated material, or 2500 psi concrete, as approved. Suitably support pipelines or ducts in short tunnels to permit placing of backfill suitably tamped in place.

3.4 TRENCH BACKFILL

- A. General: Backfill material shall be clean earth fill composed of sand, clay and sand, sand and stone, crushed stone, or an approved combination thereof. Backfilling shall be accomplished under two specified requirements: First Lift, from trench grade to a point 12 inches above the top of the utility, and, Second Lift, from the top of the First Lift to the ground surface. Where thrust blocks, encasements, or other below-grade concrete work have been installed, backfilling shall not proceed until the concrete has obtained sufficient strength to support the backfill load.
- B. First Lift: Fine material shall be carefully placed and tamped around the lower half of the utility. Backfilling shall be carefully continued in compacted and tested layers not exceeding 6 inches in thickness for the full trench width, until the fill is 12 inches above the top of the utility, using the best available material from the excavation, if approved. The material for these first layers of backfill shall be lowered to within 2 feet above the top of pipes before it is allowed to fall, unless the material is placed with approved devices that protect the pipes from impact. The "First Lift" shall be thoroughly compacted and tested before the "Second Lift" is placed. Unless otherwise specified, compaction shall equal 98% of maximum density, as determined by ASTM D 1557. The "First Lift" backfill shall exclude stones, or rock fragments larger than the following:

(Greatest Dimension-Inches)	
<u>Pipe Type</u>	<u>Fragment Size (Inches)</u>
Steel	2
Concrete	2
Ductile Iron	2
Plastic	1
Fiberglass	1

- C. Second Lift: The remainder of the trench, above the "First Lift", shall be backfilled and tested in layers not exceeding 6 inches. The maximum dimension of a stone, rock, or pavement fragment shall be 6 inches. When trenches are cut in

pavements or areas to be paved, compaction, as determined by ASTM D 1557, shall be equal to 98% of maximum density, with compaction in other areas not less than 95% of maximum density in unpaved portions of the Rights-of-Way or 90% of maximum density in other areas.

As an alternative, or if required under roadways, Flowable Fill may be substituted. If Flowable Fill is to be used, a fabric mesh shall be installed between the "first lift" and the Flowable Fill. Flowable Fill shall be in accordance with Section 4.7.AH of the Lee County Utilities Operations Manual.

- D. **Compaction Methods:** The above specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with exception that the first two feet of backfilling over the pipe shall be compacted by hand-operated tamping devices. Flooding or puddling with water to consolidate backfill is not acceptable, except where sand is the only material utilized and encountered and the operation has been approved by the OWNER.
- E. **Density Tests:** Density tests for determination of the above specified compaction shall be made by an independent testing laboratory and certified by a Florida Registered, Professional ENGINEER at the expense of the Developer or CONTRACTOR. Test locations will be determined by the OWNER but in any case, shall be spaced not more than 100 feet apart where the trench cut is continuous. If any test results are unsatisfactory, the CONTRACTOR shall re-excavate and re-compact the backfill at his expense until the desired compaction is obtained. Additional compaction tests shall be made to each site of an unsatisfactory test, as directed, to determine the extent of re-excavation and re-compaction if necessary.

Copies of all density test results shall be furnished on a regular basis by the ENGINEER, to Lee County Utilities. Failure to furnish these results will result in the project not being recommended for acceptance by Lee County

- F. **Dropping of Material on Work:** Do trench backfilling work in such a way as to prevent dropping material directly on top of any conduit or pipe through any great vertical distance. Do not allow backfilling material from a bucket to fall directly on a structure or pipe and, in all cases, lower the bucket so that the shock of falling earth will not cause damage.
- G. **Distribution of Large Materials:** Break lumps up and distribute any stones, pieces of crushed rock or lumps which cannot be readily broken up, throughout the mass so that all interstices are solidly filled with fine material.

3.5 STRUCTURE BACKFILL

- A. **Use of Select Fill:** Use select fill underneath all structures, and adjacent to structures where pipes, connections, electrical ducts and structural foundations

are to be located within this fill. Use select fill beneath all pavements, walkways, and railroad tracks, and extend to the bottom of pavement base course or ballast.

1. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable approved mechanical or pneumatic equipment.
 2. Compact backfill to not less than 95 percent of the maximum dry density as determined by ASTM D 1557.
- B. Use of Common Fill: Use common granular fill adjacent to structures in all areas not specified above, unless otherwise shown or specified. Select fill may be used in place of common granular fill at no additional cost.
1. Extend such backfill from the bottom of the excavation or top of bedding to the bottom of subgrade for lawns or lawn replacement, the top of previously existing ground surface or to such other grades as may be shown or required.
 2. Place backfill in uniform layers not greater than 8 inches in loose thickness and thoroughly compact in place with suitable equipment, as specified above.
 3. Compact backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.
- C. Use of Clay: In unpaved areas adjacent to structures for the top 1 foot of fill directly under lawn subgrades use clay backfill placed in 6-inch lifts. Compact clay backfill to not less than 90 percent of the maximum dry density as determined by ASTM D 1557.
1. Use clay having a liquid limit less than or equal to 40 and a plasticity index less than or equal to 20.

3.6 DRAINAGE BLANKET

Not Used.

3.7 EARTH EMBANKMENTS

Not Used.

3.8 COMPACTION EQUIPMENT

- A. Equipment and Methods: Carry out all compaction with suitable approved equipment and methods.

1. Compact clay and other cohesive material with sheep's-foot rollers or similar equipment where practicable. Use handheld pneumatic tampers elsewhere for compaction of cohesive fill material.
2. Compact low cohesive soils with pneumatic-tire rollers or large vibratory equipment where practicable. Use small vibratory equipment elsewhere for compaction of cohesionless fill material.
3. Do not use heavy compaction equipment over pipelines or other structures, unless the depth of fill is sufficient to adequately distribute the load.

3.9 BORROW

- A. Should there be insufficient material from the excavations to meet the requirements for fill material, borrow shall be obtained from pits secured and tested by the CONTRACTOR and approved by the OWNER. Copies of all test results shall be submitted to Lee County Utilities.

3.10 FINISH GRADING

- A. Final Contours: Perform finish grading in accordance with the completed contour elevations and grades shown and blend into conformation with remaining natural ground surfaces.
 1. Leave all finished grading surfaces smooth and firm to drain.
 2. Bring finish grades to elevations within plus or minus 0.10 foot of elevations or contours shown.
- B. Surface Drainage: Perform grading outside of building or structure lines in a manner to prevent accumulation of water within the area. Where necessary or where shown, extend finish grading to ensure that water will be carried to drainage ditches, and the site area left smooth and free from depressions holding water.

3.11 RESPONSIBILITY FOR AFTERSETTLEMENT

- A. Aftersettlement Responsibility: Take responsibility for correcting any depression which may develop in backfilled areas from settlement within one year after the work is fully completed. Provide as needed, backfill material, pavement base replacement, permanent pavement, sidewalk, curb and driveway repair or replacement, and lawn replacement, and perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as approved.

3.12 INSPECTION AND TESTING OF BACKFILLING

- A. Sampling and Testing: Provide sampling, testing, and laboratory methods in accordance with the appropriate ASTM Standard Specification. Subject all backfill to these tests.
- B. Compaction density tests shall be made at all such backfill areas with spacing not to exceed 100 feet apart and on each 6-inch compacted layer.
- C. Correction of Work: Correct any areas of unsatisfactory compaction by removal and replacement, or by scarifying, aerating or sprinkling as needed and recompaction in place prior to placement of a new lift.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 31 31 16

SOIL TREATMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes soil treatment for termite control.

1.3 DEFINITIONS

- A. EPA: Environmental Protection Agency.
- B. PCO: Pest control operator.

1.4 SUBMITTALS

- A. Product Data: Treatment and application instructions, including EPA-Registered Label and Material Safety Data Sheets (MSDS).
- B. Product Certificates: Signed by manufacturers of termite control projects certifying that treatments furnished comply with EPA regulations for termiticides.
- C. Certificate of Compliance: As detailed in “Quality Assurance” article.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for OWNER’s record information, including the following as applicable:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Brand name and manufacturer of termiticide.

4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

E. Warranties: Special warranties specified in this section.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: APCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where project is located and who is experienced and has completed termite control treatment similar to that indicated for this project and whose work has a record of successful in-service performance.

B. Certificate of Compliance: As per the 2001 Florida Building Code Section 1816.1.7 "The rules and laws as established by the Florida Department of Agriculture and Consumer Services shall be deemed as approved with respect to pre-construction soil treatment for protection against subterranean termites. A Certificate of Compliance shall be issued to the building department by the licensed pest control company that contains the following statement:

'The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accordance with rules and laws established by the Florida Department of Agriculture and Consumer Services.'

C. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.7 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive OWNER of other rights OWNER may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by CONTRACTOR under requirements of the Contract Documents. Warranty Period: Five years from date of Substantial Completion.

- B. Special Warranty: Written warranty, signed by applicator and CONTRACTOR certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation without cost to the OWNER up to \$50,000 in value.

PART 2 – PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Fuel oil will not be permitted as a dilutant. Use only soil treatment solutions that are not harmful to plants, Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AgrEvo Environmental Health, Inc.; a Company of Hoechst and Schering, Berlin.
 - 2. Bayer Advanced

3. Dow Agro Sciences .
4. FMC Corp.; Pest Control Specialties.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps or stakes, formwork, and construction waste wood from soil and foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.
- C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION - GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.
- B. Per the 2014 Florida Building Code:

1. Initial chemical soil treatment inside the foundation perimeter shall be done after all excavation, backfilling and compaction is complete.
2. Soil area disturbed after initial chemical soil treatment shall be retreated with a chemical soil treatment, including spaces boxed or formed.
3. Space in concrete floors boxed out or formed for the subsequent installation of plumbing traps, drains or any other purpose shall be created by using plastic or metal permanently placed forms of sufficient depth to eliminate any planned soil disturbance after initial chemical soil treatment.
4. Treated soil shall be protected with a minimum 6-mil vapor retarder to protect against rainfall dilution. If rainfall occurs before vapor retarder placement, retreatment is required. Any work, including placement of reinforcing steel, done after chemical treatment until the concrete floor is poured, shall be done in such manner as to avoid penetrating or disturbing treated soil.
5. Concrete overpour or mortar accumulated along the exterior foundation perimeter shall be removed prior to exterior chemical soil treatment, to enhance vertical penetration of the chemicals.
6. Chemical soil treatments shall also be applied under all exterior concrete or grade within 1 foot of the primary structure sidewalls. Also, a vertical chemical barrier shall be applied promptly after construction is completed, including initial landscaping and irrigation/sprinkler installation. Any soil disturbed after the chemical vertical barrier is applied shall be promptly retreated.
7. Protective sleeves around metallic piping penetrating concrete slab-on-grade floors shall not be of cellulose-containing materials and shall receive application of a termiticide in annular space between sleeve and pipe.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated

zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 3. Crawlspace: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
 4. Masonry: Treat voids.
 5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Post warning signs in areas of application.
- D. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 31 16

SECTION 31 40 00

SHORING, SHEETING AND BRACING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Work required for protection of an excavation or structure through shoring, sheeting, and bracing.
- B. Related Work Specified in Other Sections Includes:
 - 1. Section 31 23 16 - Excavation - Earth and Rock
 - 2. Section 31 23 23 - Backfilling

1.2 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. CONTRACTOR's Submittals: All sheeting and bracing shall be the responsibility of the CONTRACTOR to retain qualified design services for these systems, and to be completed with strict adherence to OSHA Regulations. Submit complete design calculations and working drawings of proposed shoring, sheeting and bracing which have been prepared, signed and sealed by a Licensed Professional Engineer experienced in Structural Engineering and registered in the State of Florida, before starting excavation for jacking pits and structures. Use the soil pressure diagram shown for shoring, sheeting and bracing design. ENGINEER's review of calculations and working drawings will be limited to confirming that the design was prepared by a licensed professional engineer and that the soil pressure diagram shown was used.

1.3 REFERENCES

- A. Design: Comply with all Federal and State laws and regulations applying to the design and construction of shoring, sheeting and bracing.
- B. N.B.S. Building Science Series 127 "Recommended Technical Provisions for Construction Practice in Shoring and Sloping Trenches and Excavations.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Do work in accordance with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety Act of 1970 (PL 91-596) and under Section 107 of the

Contract Work Hours and Safety Standards Act (PL 91-54), and the Florida Trench Safety Act. The CONTRACTOR shall also observe 29 CFR 1910.46 OSHA's regulation for Confined Space Entry.

PART 2 PRODUCTS

2.1 MANUFACTURERS AND MATERIALS

- A. Material Recommendations: Use manufacturers and materials for shoring, sheeting and bracing as recommended by the Licensed Professional Engineer who designed the shoring, sheeting, and bracing.

PART 3 EXECUTION

3.1 SHORING, SHEETING AND BRACING INSTALLATION

- A. General: Provide safe working conditions, to prevent shifting of material, to prevent damage to structures or other work, to avoid delay to the work, all in accordance with applicable safety and health regulations. Properly shore, sheet, and brace all excavations which are not cut back to the proper slope and where shown. Meet the general trenching requirements of the applicable safety and health regulations for the minimum shoring, sheeting and bracing for trench excavations.
 - 1. CONTRACTOR's Responsibility: Sole responsibility for the design, methods of installation, and adequacy of the shoring, sheeting and bracing.
- B. Arrange shoring, sheeting and bracing so as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength.
- C. If ENGINEER is of the opinion that at any point the shoring, sheeting or bracing are inadequate or unsuited for the purpose, resubmission of design calculations and working drawings for that point may be ordered, taking into consideration the observed field conditions. If the new calculations show the need for additional shoring, sheeting and bracing, it should be installed immediately.
- D. Monitoring: Periodically monitor horizontal and vertical deflections of sheeting. Submit these measurements for review.
- E. Accurately locate all underground utilities and take the required measures necessary to protect them from damage. All underground utilities shall be kept in service at all times as specified in Division 1.

- F. Driven Sheet piling: Drive tight sheet piling in that portion of any excavation in paved or surface streets City collector and arterial streets and in State and County highways below the intersection of a one-on-one slope line from the nearest face of the excavation to the edge of the existing pavement or surface.
- G. Sheet piling Depth: In general drive or place sheet piling for pipelines to a depth at elevation equal to the top of the pipe as approved.
 - 1. If it is necessary to drive sheet piling below that elevation in order to obtain a dry trench or satisfactory working conditions, cut the sheet piling off at the top of the pipe and leave in place sheet piling below the top of the pipe.
 - 2. No separate payment will be made for sheet piling.
 - 3. Do not cut the sheet piling until backfill has been placed and compacted to the top of the pipe.
- H. Sheet piling Removal: In general, remove sheet piling and bracing above the top of the pipe as the excavation is refilled in a manner to avoid the caving in of the bank or disturbance to adjacent areas or structures. Sheet piling shall be removed as backfilling progresses so that the sides are always supported or when removal would not endanger the construction of adjacent structures. When required to eliminate excessive trench width or other damages, shoring or bracing shall be left in place and the top cut off at an elevation 2.5 feet below finished grade, unless otherwise directed.
 - 1. Carefully fill voids left by the withdrawal of the sheet piling by jetting, ramming or otherwise.
 - 2. No separate payment will be made for filling of such voids.
- I. Permission for Removal: Obtain permission before the removal of any shoring, sheet piling or bracing. Retain the responsibility for injury to structures or to other property or persons from failure to leave such shoring, sheet piling and bracing in place even though permission for removal has been obtained.
- J. Preload internal braces to 50 percent of the design loads.
- K. Proof test tie backs to 133 percent of the design loads and lock off tie backs at 75 percent of the design loads.

3.2 SHEETING LEFT IN PLACE FOR PROTECTION

- A. Ordered Left in Place: In addition to sheet piling specified or shown to be left in place, the ENGINEER may order, in writing, any or all other shoring, sheet piling or

bracing to be left in place for the purpose of preventing injury to the structures, pipelines or to other property or to persons.

1. Cutoff sheeting left in place at the elevation shown or ordered, but, in general, at least 2.5 feet below the final ground surface.
 2. Drive up tight any bracing remaining in place.
- B. Right to Order: Do not construe the right to order shoring, sheeting and bracing left in place as creating any obligation to issue such orders.
- C. Payment: Shoring, sheeting and bracing left in place, by written order, will be paid for under the appropriate Contract Items.

END OF SECTION

SECTION 32 10 01

PAVEMENT REPAIR AND RESTORATION

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and remove and replace pavements over trenches excavated for installation of pipelines as shown on the drawings and/or specified herein.

1.2 GENERAL

- A. All damage, as a result of work under this project, done to existing pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipelines, conduits, drains, catch basins, or stabilized areas or driveways and including all obstructions not specifically named herein, shall be repaired in a manner satisfactory to the ENGINEER. Bid prices shall include the furnishing of all labor, materials, equipment, and incidentals necessary for the cutting, repair, and restoration of the damaged areas unless pay items for specific types of repair are included in the Bid Form.
- B. Keep the surface of the backfilled area of excavation in a safe condition and level with the remaining pavement until the pavement is restored in the manner specified herein. All surface irregularities that are dangerous or obstructive to traffic are to be removed. The repair shall conform to applicable OWNER or State requirements for pavement repair and as described herein.
- C. All materials and workmanship shall be first class, and nothing herein shall be construed as to relieve the CONTRACTOR from this responsibility. The OWNER reserves the right to require soil bearing or loading tests or materials tests, should the adequacy of the foundation or the quality of materials used be questionable. Costs of these tests shall be borne by the OWNER, if found acceptable; the costs of all failed tests shall be borne by the CONTRACTOR.
- D. All street and road repair shall be made in accordance with the details indicated on the drawings and in accordance with the applicable requirements of these Specifications and meeting the permit requirements and approval of the governing Department of Transportation agencies.
- E. Pavement or roadway surfaces cut or damaged shall be replaced by the CONTRACTOR in equal or better condition than the original, including stabilization, base course, surface course, curb and gutter or other appurtenances. The CONTRACTOR shall obtain the necessary permits prior to

any roadway work. Additionally, the CONTRACTOR shall provide advance notice to the appropriate authority, as required, prior to construction operations.

1. Roadway Restoration (within Lee County Department of Transportation & Engineering jurisdiction): Restoration shall be in accordance with the requirements set forth in the "Right-of-Way Utility Construction Activities Policy" and these Standards. The materials of construction and method of installation, along with the proposed restoration design for items not referred or specified herein, shall receive prior approval from Lee County DOT.
 - a. Where existing pavement is to be removed, the surface shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge parallel or perpendicular to the roadway centerline with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.
 - b. Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration. Said surfacing shall remain for a minimum of ten (10) days in order to assure the stability of the backfill under normal traffic conditions. Thirty (30) days following this period and prior to sixty (60) days after application, the temporary surfacing shall be removed and final roadway surface restoration accomplished.
 - c. In advance of final restoration, the temporary surfacing shall be removed and the existing pavement mechanically sawed straight and clean to the stipulated dimensions, if needed. Following the above operation, the CONTRACTOR shall proceed immediately with final pavement restoration in accordance with the requirements set forth by Lee County Department of Transportation.
2. Roadway Restoration (outside Lee County Department of Transportation jurisdiction) – Work within the rights-of-way of public thoroughfares which are not under jurisdiction of Lee County, shall conform to the requirements of the Governmental agency having jurisdiction or the Florida Department of Transportation, if no governmental agencies have jurisdiction. Work within State Highway right-of-way shall be in full compliance with all requirements of the permit drawings, and to the satisfaction of the Florida Department of Transportation.

1.3 QUALITY ASSURANCE

- A. Applicable provisions of the latest version of the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction", and

Supplemental Specifications hereunder govern the work under this Section. The Florida Department of Transportation will hereafter be referred to as FDOT.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All materials utilized in flexible base pavement and base course shall be as specified in the latest version of the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction".

PART 3 EXECUTION

3.1 CUTTING PAVEMENT

- A. Cut and remove pavement as necessary for installing the new pipelines and appurtenances and for making connections to existing pipelines.
- B. Before removing pavement, the pavement shall be marked for cuts nearly paralleling pipelines and existing street lines. Asphalt pavement shall be cut along the markings with a jackhammer, rotary saw, or other suitable tool, leaving a uniform and straight edge with minimum disturbance to the remaining adjacent surface.
- C. No pavement shall be machine pulled until completely broken and separated along the marked cuts.
- D. The pavement adjacent to pipeline trenches shall neither be disturbed nor damaged. If the adjacent pavement is disturbed or damaged, irrespective of cause, remove the damaged pavement and shall replace it at his own expense.

3.2 GENERAL RESTORATION

- A. The restoration of existing street paving, driveways, etc., shall be restored, replaced or rebuilt using the same type of construction as was in the original. Be responsible for restoring all such work, including sub-grade and base courses where present. Obtain and pay for such local or other governmental permits as may be necessary for the opening of streets. Meet any requirements other than those herein set forth which may affect the type, quality and manner of carrying on the restoration of surfaces by reason of jurisdiction of such governmental bodies.
- B. In all cases, maintain, without additional compensation, all permanent replacement of street paving, done by him under this Contract until accepted by the OWNER, including the removal and replacement of such work wherever surface depressions or underlying cavities result from settlement of trench backfill.

- C. Complete all the final resurfacing or re-paving of streets or roads, over the excavations and relay paving surfaces of roadbed that have failed or been damaged prior to acceptance by the OWNER. Backfilling of trenches and the preparation of sub-grades shall conform to the requirements of Section 31 23 23.
- D. All re-paving or resurfacing shall be done in accordance with Florida Department of Transportation Specifications, to which the following requirement of trench backfill will be added: Where pipeline construction crossed paved areas such as streets, the top 24 inches of trench below the road bases or concrete slabs shall be backfilled with compacted A-4 or better matter that will provide a bearing value of not less than 75 when tested by the Florida Department of Transportation Soil Bearing Test Methods.

3.3 PRIME AND TACK COATS

- A. The work shall consist of the application of bituminous prime and tack coats on the previously prepared base course in accordance with Section 300 of the FDOT Specifications.

3.4 WEARING COURSE

- A. The work shall consist of the construction of plant-mixed hot bituminous pavement to the thickness indicated in the drawings conforming to Type III asphaltic concrete in accordance with Section 333 of the FDOT Specifications. The requirements for plant and equipment are specified in Section 320 and the general construction requirements for asphaltic concrete pavement are contained in Section 330 of the FDOT specifications.

3.5 TESTING

- A. All field testing shall be performed by an independent laboratory employed by the OWNER. All materials shall be tested and certified by the producer. Tests repeated because sub-grade or base does not meet specified compaction shall be at the CONTRACTOR's expense.

3.6 MISCELLANEOUS RESTORATION

- A. Sidewalks cut or damaged by construction shall be restored in full sections or blocks to a minimum thickness of four inches. Concrete curb or curb gutter shall be restored to the existing height and cross section in full sections or lengths between joints. Concrete shall be as specified on the drawings. Grassed yards, shoulders and parkways shall be restored to match the existing sections with grass seed or sod of a type matching the existing grass.

3.7 CLEANUP

- A. After all repair and restoration or paving has been completed, all excess asphalt, dirt, and other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 32 16 00

SIDEWALKS, DRIVEWAYS AND CURBS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Sidewalks, sidewalk ramps, driveways, curbs and drive approaches complete with concrete materials, concrete curing compounds, joint materials, field quality control and appurtenances.

1.2 REFERENCES

- A. Reference Standards: Conform the work for this Section to the applicable portions of the following standard Specifications.
 - 1. ASTM - American Society of Testing and Materials
 - 2. AASHTO - American Association of State Highway and Transportation Officials
 - 3. FDOT - Florida Department of Transportation - Standard Specifications for Road and Bridge Construction.
 - 4. FAC - Florida Accessibility Code.
 - 5. ADAAG - American with Disabilities Act Accessibility Guidelines
 - 6. UFAS - Uniform Federal Accessibility Standards

1.3 SUBMITTALS

- A. Reports: Written permission for the use of all local disposal sites Furnish copies to the ENGINEER.

1.4 JOB CONDITIONS

- A. Environmental Requirements:
 - 1. Temperature: Comply with the requirements for concrete installation due to outside ambient air temperatures as specified under Article 3.3.I of this Section.
- B. Protection:
 - 1. Protection Against Rain: Comply with the requirements for protecting new work against damage from Rain, as specified under Article 3.3.I of this Section.

2. Protection Against Cold Weather: Comply with the requirements for protecting new work against damage from cold weather, as specified under Article 3.3.1 of this Section.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Concrete: Use 2,500 psi concrete except as modified herein.
- B. Ready-Mixed Concrete: Use ready-mixed concrete which conforms to ASTM C94, Alternate 2.
- C. Water: Use water for mixing and curing concrete reasonably clean and free from oil, salt, acid, alkali, chlorides, sugar, vegetable, or other substances injurious to the finished product. Waters from sources approved by the local Health Department as potable may be used without test. Test water requiring testing in accordance with the current Method of Test for Quality of Water to be Used in Concrete, AASHTO T-26.
- D. Concrete Curing Compounds: Use white membrane curing compound for curing concrete which conforms to AASHTO M148, Type 1 clear, or Type 2 while per FDOT Section 925.
- E. Premolded Joint Filler: Use fiber joint filler which conforms to ASTM D1751. Use filler of the thickness, as specified herein, or as directed by the ENGINEER.
- F. Steel Hook Bolts: Use hook bolts which conform to ASTM A706, or for Grade 60 of ASTM A615, A616, or A617. Use 5/8-inch diameter hook bolts self tapping.
- G. Joint Sealant: Use hot-poured type joint sealant which conforms to ASTM D1190.

PART 3 EXECUTION

3.1 CONTRACTOR'S VERIFICATION

- A. Excavation and Forming: Prior to the installation of any concrete, examine the excavation and forms for the proper grades, lines, and levels required to receive the new work. Ascertain that all excavation and compacted subgrades are adequate to receive the concrete to be installed.
 1. Correct all defects and deficiencies before proceeding with the work.
- B. Existing Improvements: Investigate and verify location of existing improvements to which the new work is to be connected.

1. Making necessary adjustment in line and grade to align the new work with the existing improvements must be approved by the ENGINEER prior to any change.

3.2 PREPARATION

- A. Forms: Use wood or metal forms, straight and free from warp, clean, and sufficient strength to resist springing during the process of depositing concrete against them.

1. Use full depth of the concrete forms.

3.3 INSTALLATION

- A. Sidewalks, Sidewalk Ramps, Driveways and Driveway Approaches: Construct all sidewalks and sidewalk ramps six (6) inches thick. Construct sidewalks five (5) feet wide unless otherwise noted on the Plans or directed by the ENGINEER, and slope per ADA requirements. Normally, sidewalks will be located within the right-of-way, parallel the property lines, at a distance of 1-foot from the property line.

1. Construct alleys, driveways and approaches six (6) inches thick. Construct the width of the driveways and driveway approaches as shown on the Plans or as directed by the ENGINEER.

- B. Removal of Existing Curb for Sidewalk Ramps and Driveway Approaches: Conform construction of sidewalk ramps within street intersections where curbed pavement existing to the current FDOT Roadway and Traffic Design Standards.

1. Saw cut, to full depth of pavement, and remove a minimum of an 18-inch wide curb and gutter section where there is no proper curb drop for the sidewalk ramp or driveway approach. When mountable curbs are present, remove a 24-inch wide curb and gutter section for the construction of sidewalk ramps, as specified above.

2. Remove curb and gutter as determined by the ENGINEER in the field but remove curb and gutter at least as wide as the proposed sidewalk ramp plus 1-foot on each side.

3. Replace the removed curb and gutter section with materials, equal to what was removed and seal joint with hot poured rubber asphalt.

- C. Install 5/8 inch diameter self tapping hook bolts, in the existing concrete pavement as indicated on the Plans prior to placing concrete for the removed curb and gutter section.

- D. Placement of Forms: Use wood forms, straight and free from warp, of nominal depth for sidewalk sections less than 25 feet in length.
1. Stake forms to line and grade in a manner that will prevent deflection and settlement.
 2. When unit slab areas are to be poured, place slab division forms such that the slab division joints will be straight and continuous.
 3. Set forms for sidewalk ramps to provide a grade toward the centerline of the right-of-way in accordance with current standards. Use a uniform grade, except as may be necessary to eliminate short grade changes.
 4. Oil forms before placing concrete. Leave forms in place at least 12 hours after the concrete is placed. Place forms ahead of the pouring operations to maintain uninterrupted placement of concrete.
 5. The use of slip form pavers can be allowed when approved by the ENGINEER in lieu of the construction system described above.
- E. Joints: Construct transverse and longitudinal expansion and plane-of-weakness joints at the locations specified herein, or as indicated on the Plans or as directed by the ENGINEER.
1. Place the transverse expansion joints for the full width and depth of the new work. Use transverse expansion joints placed against an existing pavement a minimum of six (6) inches deep but no less than the thickness of the concrete being placed.
 2. Conform longitudinal expansion joints to the requirements as transverse expansion joints.
 3. Construct joints true to line with their faces perpendicular to the surface of the sidewalk. Install the top slightly below the finished surface of the sidewalk. Construct transverse joints at right angles to the centerline of the sidewalk and construct longitudinal joints parallel to the centerline or as directed by the ENGINEER.
 4. Place transverse expansion joints, 1/2-inch thick, through the sidewalk at uniform intervals of not more than 50 feet and elsewhere as shown on the Plans, or as directed by the ENGINEER.
 5. Place expansion joints, 1/2-inch thick, between the sidewalk and back of abutting parallel curb, buildings or other rigid structures, concrete driveways and driveway approaches. When directed by the ENGINEER, place the

expansion joint between sidewalks and buildings 1-foot from the property line and parallel to it.

6. Form plane-of-weakness joints every five (5) feet. Form joints by use of slab divisions forms extending to the full depth of the concrete or by cutting joints in the concrete, after floating, to a depth equal to 1/4 the thickness on the sidewalk. Construct cut joints not less than 1/8-inch or more than 1/4-inch in width and finish smooth and at right angles to the centerline on the sidewalk.
- F. Placing and Finishing Concrete: Place all concrete on a prepared unfrozen, smooth, leveled, rolled and properly compacted base. Place concrete on a moist surface with no visible water present.
1. Deposit the concrete, in a single layer to the depth specified. Spade or vibrate and compact the concrete to fill in all voids along the forms and joints. Strike off the concrete with a strike board until all voids are removed and the surface has the required grade and cross section as indicated on the Plans, or as directed by the ENGINEER.
 2. Float the surface of the concrete just enough to produce a smooth surface free from irregularities. Round all edges and joints with an edger having a 1/4-inch radius.
 3. Broom the surface of sidewalks, driveways and approaches to slightly roughen the surface.
 4. Texture the surface of the sidewalk ramps with a coarse broom transversely to the ramp slope, and coarser roughen than the remainder of the sidewalk. Contrast the ramp slope in color (using a brick-red dye or approved equal) from the remainder of the sidewalk. Comply with minimum color contrast and slope requirements from FAC, UFAS, ADAAG, Local Government Standards, or as directed by the ENGINEER.
- G. Curing: After finishing operations have been completed and immediately after the free water has left the surface, completely coat and seal the surface of the concrete (and sides if slip-forming is used) with a uniform layer of white membrane curing compound. Do not thin the curing compound. Apply the curing compound at the rate of one gallon per 200 square feet of surface.
- H. Barricades: Place suitable barricades and lights around all newly poured sidewalks, sidewalk ramps, driveways, driveway approaches and curb and gutter sections in order to protect the new work from damage from pedestrians, vehicles and others until the concrete has hardened.

1. Leave barricades in place for a minimum of two (2) days, except for driveway approaches and curb and gutter sections. Leave barricades in place for a minimum of three (3) days.
 2. Remove and replace any concrete that suffers surface or structural damage at no additional cost.
- I. Protection:
1. Against Rain: Protect new concrete from the effects of rain before the concrete has sufficiently hardened. Have available on the job site at all times enough burlap or 6-mil thick polyurethane film to cover and protect one day's work. Stop work and cover completed work when rain appears eminent. As soon as the rain ceases, uncover the concrete and burlap drag the surface where necessary. Apply curing compound to any areas where the compound has been disturbed or washed away.
 2. Against Cold Weather: If concrete is placed between December 15 and February 15, have available on the site sufficient amount of clean, dry straw or hay to cover one (1) day's production. If the temperature reaches 40 degrees F and is falling, place the hay or straw 12 inches thick, immediately after the curing compound is applied.
 3. Concrete Temperature Limitations: Do not place concrete when the temperature of the concrete at the point of placement is above 90 degrees F.
- J. Cleanup: After the concrete has gained sufficient strength, but no sooner than within 12 hours, remove the fixed forms and backfill the spaces on both sides with sound earth of topsoil quality. Compact, level and leave backfill in a neat condition.
- K. Gutters and Curbs: Construct gutters and curbs in accordance with Section 520 FDOT Standard Specifications for Road and Bridge Construction, latest edition, including supplements.

3.4 FIELD QUALITY CONTROL

- A. Concrete Delivery Ticket: Use a ticket system for recording the transportation of concrete from the batching plant to point of delivery. Issue this ticket to the truck operator at the point of loading and give to the ENGINEER upon delivery.
- B. Concrete Delivery Rejection: Remove concrete not permitted for inclusion in the work by the ENGINEER from the site. Rejection of concrete will be determined through Field Quality Control and elapsed time from mixer charging to delivery.

- C. Concrete Testing at Placement: Perform tests of each batch of concrete delivered, each 50 cubic yards, or whenever consistency appears to vary. The sampling and testing of slump, air content and strength will be performed at no cost to the CITY.
1. Sampling: Secure composite samples in accordance with the Method of Sampling Fresh Concrete, ASTM C172.
 2. Slump Test: Test in accordance with ASTM C143. Use the least slump possible consistent with workability for proper placing of the various classifications of concrete.
 - a. Place structural concrete for walls and slabs, by means of vibratory equipment, with a slump of four (4) inches.
 - b. A tolerance of up to 1-inch above the indicated maximum will be allowed for individual batches provided the average for all batches or the most recent ten (10) batches tested, whichever is fewer, does not exceed the maximum limit.
 3. Air Content: Determine air content of normal weight concrete in accordance with Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method, ASTM C23 1, or by the volumetric method, ASTM C 173, for each strength test.
 4. Compressive Strength: Make two (2) strength tests of three (3) samples each for each 50 cubic yards, or fraction thereof, of each mix design of concrete placed in any one (1) day.
 - a. Handling Samples: Mold and cure three (3) specimens from each sample in accordance with Method of Making and Curing Concrete Test Specimens in the Field, ASTM C31. Record any deviations from the requirements of this Standard in the test report.
 - b. Testing: Test specimens in accordance with Method of Test for Compressive Strength of Cylindrical Concrete Specimens, ASTM C39. Test one (1) specimen at seven (7) days for information and test two (2) at 28 days for acceptance. Use the average of the strengths of the two (2) specimens tested at 28 days. Discard results if one (1) specimen in a test manifests evidence of improper sampling, molding or testing, and use the strength of the remaining cylinder. Should both specimens in test shown any of the above defects, discard the entire test.
 - c. Acceptance of Concrete: The strength level of the concrete will be considered satisfactory so long as the averages of all sets of three

consecutive strength test results equal or exceed the specified 28-day strength and no individual strength test results falls below the specified 28-day strength by more than 500 psi. If the strength test is not acceptable, perform further testing to qualify the concrete.

- d. Concrete Temperature: Determine the temperature of concrete sample for each strength test.
- D. Reductions due to deficiencies in thickness or compressive strength are additive, that is, if an area is deficient by 3/8 inch and under strength by 200 psi, the total reduction is 20% plus 02% or 40% reduction.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCE AND GATE

PART 1 GENERAL

1.1 SCOPE

- A. Work specified in this Section covers materials and Work necessary for the chain link fence and gate, complete as shown on the Plans and Details.

1.2 MANUFACTURER

- A. Like items of materials provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.

1.3 SPECIFICATION AND STANDARDS REFERENCE

- A. Where supplementary specifications or standards such as ASTM, AWWA, AASHTO, etc., are referenced, such references shall be latest edition.

PART 2 PRODUCTS

2.1 FENCE MATERIALS

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing standard of quality and general configuration. Products of other manufacturers will be considered in accordance with the General Conditions.
- B. Materials shall be new and products of recognized, reputable manufacturers. Used, rerolled, or regalvanized materials are not acceptable.
- C. All materials shall be hot-dip galvanized after fabrication. Posts and other appurtenances shall have a minimum zinc coating of 1.2 ounces per square foot of surface.
- D. Fabric: Chain-link fence fabric, with a height as shown in the drawings, woven of Number 9 gauge wire in (2") two inch diamond mesh pattern, selvages twisted and barbed, galvanized after weaving with 1.2 ounce zinc coating, meeting the requirements of ASTM A 392, Class 1.

- E. Posts: Federal Specification RR-F-191, fence, posts, gates, and accessories, except as hereinafter modified. Standard lengths for setting in ground or in concrete as required for conditions shown.
- F. Line Posts: Use galvanized 2 1/2 inch outside diameter, meeting the requirements of ASTM A120, Schedule 40 steel pipe, weight 3.65 pounds per linear foot.
- G. End, Corner, Angle and Pull Posts: For end, corner, angle, and pull posts, use 2.875 inch outside diameter standard weight steel pipe, weight 5.79 pounds per linear foot.
- H. Gate Posts: For single-swing gates up to (6') six feet wide, 2.875 inch outside diameter, 5.79 pounds per foot. For single gates (6') six feet wide to (13') thirteen feet wide, (4") four inch outside diameter, 9.1 pounds per foot. For other sizes, follow manufacturer's recommendations.
- I. Post Tops: Post tops shall be pressed steel, or malleable iron, designed as a weather-tight closure cap for tubular posts. Provide one cap for each post unless equal protection is afforded by combination post top cap and barbed wire supporting arm where barbed wire is required. Where top rail is used, provide tops to permit passage of top rail.
- J. Tension Wire: Tension wire shall be zinc or aluminum-coated coil spring steel wire not less than Number 7 gauge (0.177 inch in diameter). Provide tie clips of manufacturer's standard as approved for attaching the wire to the fabric, at intervals not exceeding (24") twenty-four inches.
- K. Stretcher Bars: Stretcher bars shall be 3/16 inch by 3/4 inch. Provide one stretcher bar for each gate and end post and (2) two for each corner and pull post.
- L. Stretcher Bar Bands: Bar bands shall be heavy pressed steel, spaced not over (15") fifteen inches on center to secure stretcher bars to tubular end, corner, pull, and gate posts.
- M. Top Rail: Not less than (18') eighteen-foot-long tubular steel, 1-5/8 inch outside diameter, weight 2.27 pounds per linear foot, couplings to be outside sleeve type and at least (6") six inches long. Provide springs at one coupling in (5) five to permit expansion in rail as recommended by the manufacturer. Top rail to extend through line post tops to form continuous brace from end-to-end of each fence.
- N. Brace pipe shall be of the same material as the top rail and shall be installed midway between the top rail and extend from the terminal post to the first adjacent line post. Braces shall be securely fastened to the posts

by heavy pressed steel and malleable fittings, then securely trussed from line post to base of terminal post with a 3/8 inch truss rod and tightener.

- O. Fittings: Malleable steel, cast iron, or pressed steel, galvanized to meet the requirements of ASTM A153. Fittings to include extension arms for barbed wire, stretcher bars and clamps, clips, tension rods, brace rods, hardware, fabric bands and fastenings, and all accessories. Provide (45°) forty-five-degree bracket type supports to accommodate (3) three strands of barbed wire as shown.

2.2 GATE MATERIALS

- A. Gate shall be swing or sliding as indicated, complete with latches, stops, keepers, hinges, or rollers, and roller tracks.
- B. Gate frames shall be constructed of tubular members welded at all corners or assembled with fittings. On steel, welds shall be painted with zinc-based paint. Where corner fittings are used, gates shall have truss rods of 5/16-inch minimum nominal diameter to prevent sag or twist. Gate leaves shall have vertical intermediate bracing as required, spaced so that no members are more than (8') eight feet apart. Gate leaves (10') ten feet or larger shall have a horizontal brace or (1) one 5/16-inch minimum diagonal truss rod. When fence has barbed- wire top, the end members of the gate frames shall be extended (1') one foot above the top horizontal member to which three strands of barbed wire, uniformly spaced, shall be attached by use of bands, clips, or book bolts.
- C. Fabricate frames of standard weight pipe 1.90 inch outside diameter, weight 2.72 pounds per linear foot.
- D. Gate fabric shall be the same type as used in the fence construction. Fabric shall be attached securely to the gate frame at intervals not exceeding (15") fifteen inches.
- E. Gate hinges shall be of adequate strength for gate and with large bearing surfaces for clamping in position. Hinges shall not twist or turn under the action of the gate. Gates shall be capable of being opened and closed easily by one person.
- F. Gate latches, stops, and keepers shall be provided for all gates. Latches shall have a plunger bar arranged to engage the center stop, except that for single gates of openings less than (10') ten feet wide a forked latch may be provided. Latches shall be arranged for locking with padlocks. Center stops shall consist of device arranged to be set in concrete and to engage a plunger bar on the latch of double gates. No stop is required for single

gates. Keepers shall consist of a mechanical device for securing the free end of the gate when in the full open position.

- G. Double Gate: Size and configuration shall be as indicated. Provide gate stops for all double gates, consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar. Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.
- H. Sliding Gate: Provide manufacturer's standard heavy-duty track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories as required. All sliding gates shall be rolling, cantilever slide, or overhead (top) suspended, as indicated on Plans and Details.
- I. Rolling gate track rollers shall be malleable iron or heavy pressed steel construction, with provision for regular grease lubrication. Ground rollers shall have malleable iron or heavy pressed steel hubs with similar provision for lubrication. Gate track shall be Schedule 40 pipe, firmly attached to support posts on (7') seven-foot maximum centers. Gates more than (8') eight feet in height shall have (3) three tracks. Rolling gate frames shall be constructed similar to swing gates except diagonal bracing shall reflect different support type.
- J. Cantilever gate rollers shall have heavy malleable rollers, needle or ball bearings with fittings for regular lubrication. Maximum spacing of support posts is ten feet. Additional weight supporting posts with lower roller shall be provided on ten-foot maximum centers. Support posts shall be (4") four-inch diameter, Schedule 40, set (36") thirty-six-inch minimum depth. Top and lower rails of gate shall be 2-3/8 inch O.D., Schedule 40 pipe. Vertical support posts shall be on (6') six foot maximum spacing, 1-7/8 inch O.D. by Schedule 40 pipe, all diagonal bracing 1-5/6 inch O.D. by Schedule 40 pipe, all connections welded and painted.
- K. Keeper: Provide keeper for all vehicle gates, which automatically engages the gate leaf and holds it in the OPEN position until manually released.

2.3 CHAIN AND LOCK MATERIALS

- A. Immediately upon installation of chain link fence and gates, case hardened chain of adequate length to secure gate and a locked padlock shall be installed to keep the site clear except when Contractor is working on site. Padlocks shall be Master, Size 3, with Master key Number 3623, or as specified by the Owner.

- B. If the above Master keyed padlocks are not available from the supplier at the time of enclosure installation, other padlocks shall be installed until such time as the specified locks are available.

2.4 GATE OPERATOR SYSTEM

Not Used.

2.5 CONCRETE

- A. All concrete and concrete Work shall conform to the following specifications, unless otherwise noted on the Plans. All concrete specified in this Section shall attain a minimum compressive strength of (3000) three thousand psi in (28) twenty-eight days.
- B. Concrete Mix Materials: Coarse aggregate shall be hard, clean, washed gravel or crushed stone. The maximum aggregate size shall not be larger than one inch nor smaller than 1/2-inch equivalent diameter. Fine aggregate shall be clean, sharp sand. Water shall be clean, fresh, free from injurious amounts of materials, organic substances, acids, or alkalis. Cement shall be Type I, Domestic Portland Cement, conforming to ASTM C150, latest revision.
- C. Concrete Admixtures: Air entrainment admixtures in concrete are permitted in accordance with manufacturer's specifications provided the specified strength and quality are maintained, and unless the admixtures appear to be causing abnormal field results, and provided that the total entrained air content does not exceed (5%) five percent. No other admixture of any type will be permitted without the written approval of the Engineer.
- D. Transit or Ready-Mixed Concrete: Transit or ready-mixed concrete may be used provided it meets the requirements of ASTM C94, Ready-Mixed Concrete, specifications herein stated, and provided the central plant producing the concrete, the batching, mixing and transportation equipment, in the opinion of the Engineer, is suitable for the production and transportation of the specified concrete.

2.6 FENCE GROUNDING

- A. General: Ground fence, gates, and gate operators. Provide all necessary grounding installation hardware.
- B. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Copper.

2. Material on or below Finished Grade: Copper.
 3. Bonding Jumpers: Braided copper tape, 1-inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- C. Connectors and Grounding Rods: Comply with UL 467.
1. Connectors for Below-Grade Use: Exothermic welded type.
 2. Grounding Rods: Copper-clad steel.

PART 3 EXECUTION

3.1 INSTALLATION OF CHAIN LINK FENCE AND GATE

- A. Installation of fencing shall meet the requirements of ASTM F567.
- B. Fencing shall be installed in straight lines between angle points. Fencing installation shall be in accordance with the manufacturer's recommendations and with these Specifications. Postholes shall be a minimum depth of (3') three feet below finished grade. Holes for line posts shall be nine inches in diameter. Holes for gate, corner, and pull posts shall be (16") sixteen inches in diameter. Post space shall not exceed (10') ten feet on centers and in true lines. Posts shall be plumb and to a depth of (2') two feet, (10") ten inches. Top rail of the fence shall be at the top of the fabric. Remainder of hole shall have concrete around the posts to a point (2") two inches above finished grade. Top surface shall have a crown watershed finish. Concrete shall cure prior to installing accessories. Chain link fabric shall be fastened to end posts with stretcher bars and clamps and to line posts and top rail with wire or bands at approximately (14") fourteen-inch center and (24") twenty-four-inch center, respectively. (3) Three strands of barbed wire shall be installed on the brackets. Gateposts shall be braced diagonally to adjacent line posts to ensure stability. Gates shall be hung and adjusted so gates operate from open or closed position in accordance with the manufacturer's recommendations.
- C. Cleanup: Contractor shall clean up and finish grade all areas disturbed by his construction.

D. Gate Operator Systems

1. Not Used.

E. Electrical Grounding

1. Ground fences at a maximum interval of 1,000 feet in accordance with applicable requirements of IEEE C2, National Electrical Safety Code. Ground each gate to ensure gate remains grounded while operating.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 32 92 00

LAWN RESTORATION

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. The work in this section consists of furnishing all labor, material and equipment to replace and maintain all areas disturbed during construction by establishing a stand of grass, within the areas called for by the furnishing and placing grass sod, or seeding, or seeding and mulching.

1.2 REFERENCE DOCUMENTS

- A. The materials used in this work shall conform to the requirements of Florida Department of Transportation Standard Specifications for Road and Bridge Construction as follows:
 - 1. Sod - Section 981-2
 - 2. Fertilizer - Section 982
 - 3. Water - Section 983

1.3 SUBMITTALS

- A. Submit certifications and identification labels for all sodding supplied as specified in Section 01 33 00.

PART 2 PRODUCTS

2.1 SODDING

- A. Types: Sod may be of either St. Augustine or Argentine Bahia grass or as that disturbed, as established prior to construction. It shall be well matted with roots. When replacing sod in areas that are already sodded, the sod shall be the same type as the existing sod.
- B. Sod shall be provided as required in accordance with Florida Department of Transportation Specifications 575 and 981. The CONTRACTOR shall furnish sod equal to and similar in type as that disturbed. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575.
- C. The sod shall be taken up in commercial-size rectangles, preferably 12-inch by 24-inch or larger, except where 6-inch strip sodding is called for.
- D. The sod shall be sufficiently thick to secure a dense stand of live grass. The sod shall be live, fresh and uninjured at the time of planting. It shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary

handling. It shall be reasonably free of weeds and other grasses. It shall be planted as soon as possible after being dug and shall be shaded and kept moist from the time it is dug until it is planted.

- E. Sod should be handled in a manner to prevent breaking or other damage. Sod shall not be handled by pitch forks or by dumping from trucks or other vehicles. Care shall be taken at all times to retain the native soil on the roots of each sod roll during stripping and handling. Sod that has been damaged by handling during delivery, storage or installation will be rejected.

2.2 FERTILIZER

- A. Chemical fertilizer shall be supplied in suitable bags with the net weight certification of the shipment. Fertilizer shall be 12-8-8 and comply with Section 982 of the FDOT Standard Specification for Road and Bridge Construction.
- 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 12-8-8, with at least 50 percent of the nitrogen from a nonwater-soluble organic source. The nitrogen source may be a unreaformaldehyde source provided it is not derived from a waste product of the plastic industry.

2.3 EQUIPMENT

- A. The device for spreading fertilizer shall be capable of uniformly distributing the material at the specified rate.

2.4 NETTING

- A. Netting is fabricated of material similar to Geoscope Landscape Fabric or approved equal.

2.5 GRASSING

- A. The CONTRACTOR shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications.
- B. Grass seed shall be Argentine Bahia, 60 #/acre March 1 to November 1, 50 #/acre with 20 #/acre of rye grass seed November 1 to March 1. Argentine Bahia seed shall be a scarified seed having a minimum active germination of 40% and total of 85%.

- C. Mulch material shall be free of weeds and shall be oat straw or rye, Pangola, peanut, Coastal Bermuda, or Bahia grass hay.

2.6 TOPSOIL

- A. Topsoil stockpiled during excavation may be used. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the OWNER. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants, and grassing specified herein.

2.7 MULCH

- A. Mulch shall be fresh cypress mulch. Rate of application specified herein shall correspond to depth not less than 1-inch or more than 3-inches according to texture and moisture content of mulch material.

2.8 WATER

- A. It is the CONTRACTOR'S responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The CONTRACTOR shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments, and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 EXECUTION

3.1 SOD BED PREPARATION

- A. Areas to be sodded and/or seeded shall be cleared on all rough grass, weeds, and debris, and brought to an even grade.
- B. The soil shall then be thoroughly tilled to a minimum 8-inch depth.
- C. The areas shall then be brought to proper grade, free of sticks, stones, or other foreign matter over 1-inch in diameter or dimension. The surface shall conform to finish grade, less the thickness of sod, free of water-retaining depressions, the soil friable and of uniformly firm texture.

3.2 INSPECTION

- A. Verify that soil preparation and related preceding work has been completed.
- B. Do not start work until conditions are satisfactory.

3.3 SOD HANDLING AND INSTALLATION

- A. During delivery, prior to planting, and during the planting of sod areas, the sod panels shall at all times be protected from excessive drying and unnecessary exposure of the roots to the sun. All sod shall be stacked during construction and planting so as not to be damaged by sweating or excessive heat and moisture.
- B. After completion of soil conditioning as specified above, sod panels shall be laid tightly together so as to make a solid sodded lawn area. On mounds and other slopes, the long dimension of the sod shall be laid perpendicular to the slope. Immediately following sod laying the lawn areas shall be rolled with a lawn roller customarily used for such purposes, and then thoroughly watered.
- C. Sod shall be placed at all areas where sod existed prior to construction, on slopes of 3 horizontal on 1 vertical (3:1) or greater, in areas where erosion of soils will occur, and as directed by the ENGINEER. On areas where the sod may slide, due to height and slope, the ENGINEER may direct that the sod be pegged, with pegs driven through the sod blocks into firm earth, at suitable intervals.

3.4 USE OF SOD ON ROADWAY PROJECTS

Not Used.

3.5 SOD MAINTENANCE

- A. The sod shall produce a dense, well-established growth. The CONTRACTOR shall be responsible for the repair and re-sodding of all eroded or bare spots until project acceptance. Repair to sodding shall be accomplished as in the original work.
- B. Sufficient watering shall be done by the CONTRACTOR to maintain adequate moisture for optimum development of the seeded and sodded areas. Sodded areas shall receive no less than 1.5 inches of water per week for at least 2 weeks. Thereafter, the CONTRACTOR shall apply water for a minimum of 60 days as needed until the sod takes root and starts to grow or until final acceptance, whichever is latest.

3.6 CLEANING

- A. Remove debris and excess materials from the project site.

END OF SECTION

SECTION 33 05 01

LEAKAGE TESTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Testing for any signs of leakage in all pipelines and structures required to be watertight.
 - 1. Test drain lines by low pressure air testing.
 - 2. Test all other pipelines with water under the specified pressures.
- B. Operation of Existing Facilities: Conduct all tests in a manner to minimize as much as possible any interference with the day-to-day operations of existing facilities or other contractors working on the site.

1.2 PERFORMANCE REQUIREMENTS

- A. Written Notification of Testing: Provide written notice when the work is ready for testing and make the tests as soon thereafter as possible.
 - 1. Personnel for reading meters, gauges, or other measuring devices, will be furnished.
 - 2. Furnish all other labor, equipment, air, water and materials, including meters, gauges, smoke producers, blower, pumps, compressors, fuel, water, bulkheads and accessory equipment.

1.3 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. AWWA C 600 - Installation of Ductile-Iron Water Mains and Their Appurtenances
 - 2. AWWA C 906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 in. through 65 in. for Waterworks

1.4 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.

- B. Testing Report: Prior to placing the system in service submit for review and approval a detailed bound report summarizing the leakage test data, describing the test procedure and showing the calculations on which the leakage test data is based.

- 1. Reference Drain Line Data

- a. For Low Pressure Air Testing

- Not Used.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 LEAKAGE TESTING

- A. All new pipelines installed shall be tested for leakage. The test used will be Hydrostatic Testing for pressure lines and Low Pressure Air Testing for gravity lines. Tests to be performed will be indicated by the ENGINEER and witnessed by the ENGINEER and the Lee County Utilities representatives.

- 1. Flushing

- a. All mains shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall be at least 4 fps. Flushing shall be terminated at the direction of the ENGINEER. dispose of the flushing water without causing a nuisance or property damage.
 - b. Temporary flush out connections shall be installed on all dead-end water mains at the locations shown on the Drawings and in accordance with the detail shown in Section 9 of the Lee County Utilities Operations Manual.

- 2. Hydrostatic Testing

- a. HDPE Pipelines

- Perform hydrostatic testing of all HDPE pipelines as set forth in the

following, and conduct said tests in the presence of the County Manager or designee and other authorized agencies, with 48 hours advance notice provided.

Provide all labor, equipment and material required for testing the pipeline upon completion of installation, pipe laying and backfilling operations, and placement of any required temporary roadway surfacing.

Disinfect all HDPE potable water mains prior to testing in accordance with the requirements of Section 33 11 12 – Disinfection.

Test pipelines at 150 psi.

Field test all HDPE pipelines for leakage in accordance with manufacturer's recommendations for the size and class of pipeline installed. Unless other procedures recommended by the manufacturer are approved by the County Manager or designee, pressure test the pipeline as follows:

- (1) Fill pipeline slowly with water. Maintain flow velocity less than two (2) feet per second.
- (2) Expel air completely from the line during filling and again before applying test pressure. Expel air by means of taps at points of highest elevation.
- (3) Apply initial test pressure and allow to stand without makeup pressure for two (2) to three (3) hours, to allow for diametric expansion or pipe stretching to stabilize.
- (4) After this equilibrium period, apply the specified test pressure and turn the pump off. The final test pressure shall be held for not less than two (2) hours.
- (5) Upon completion of the test, the pressure shall be bled off from the location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the County Manager or designee at the point where the pressure is being monitored.

Allowable amount of makeup water for expansion of the pipeline during the pressure test shall conform to Table III, Test Phase Make-up Amount, contained in the manual "Inspections, Test and Safety Considerations" published by the Plastics Pipe Institute, Inc.

If any test of pipeline installed exceeds the amount of makeup water as allowed above, locate and repair the cause of leakage and retest the

pipeline, without additional cost to the COUNTY. Repair all visible leaks regardless of the amount of leakage.

b. All Other Pipelines

Perform hydrostatic testing of the system as set forth in the following, and shall conduct said tests in the presence of representatives from the COUNTY and other authorized agencies, with 48 hours advance notice provided.

Piping and appurtenances to be tested shall be within sections between valves unless alternate methods have received prior approval from the COUNTY. Testing shall not proceed until concrete thrust blocks are in place and cured, or other restraining devices installed. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. While the piping is being filled with water, care shall be exercised to permit the escape of air from extremities of the test section, with additional release cocks provided if required.

Hydrostatic testing shall be performed with a sustained pressure for a minimum of two (2) hours at 150 psi pressure or 2-1/2 times working pressure, whichever is higher, unless otherwise approved by Lee County Utilities, for a period of not less than two (2) hours. Testing shall be in accordance with the applicable provisions as set forth in the most recent edition of AWWA Standard C600. The allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{SD (P)^{1/2}}{133,200}$$

Where,

L = Allowable leakage in gallons per hour;

S = Length of pipe tested in feet;

D = Nominal diameter of the pipe in inches;

P = Average test pressure maintained during the leakage test in pounds per square inch

$$\text{For 150 psi, } L = (9.195 \times 10^{-5}) SD$$

The testing procedure shall include the continued application of the specified pressure to the test system, for the one hour period, by way of a pump taking supply from a container suitable for measuring water

loss. The amount of loss shall be determined by measuring the volume displaced from said container.

General. All systems associated service lines shall be constructed watertight to prevent infiltration and/or exfiltration. All new systems will be subject to low pressure air testing.

3. Low Pressure Air Test

Not Used.

3.2 LEAKAGE TESTS FOR ALUM STORAGE TANK

- A. Structure Leakage Testing: Perform leakage tests of alum storage tank before filling with liquid aluminum sulfate, by filling the structure with water to the overflow water level and observing the water surface level for the following 24 hours.
1. Make an inspection for leakage of the exterior surface of the structure, especially in areas around construction joints.
 2. Leakage will be accepted as within the allowable limits for structures from which there are no visible leaks.
 3. If visible leaks appear, repair the structure by removing and replacing the leaking portions of the structure, waterproofing the inside, or by other methods approved.
 4. Water for testing will be provided by the OWNER at the CONTRACTOR's expense.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 33 05 02

ROADWAY CROSSINGS BY OPEN CUT

PART 1 GENERAL

1.1 SCOPE OF WORK

The CONTRACTOR shall provide all labor, materials, equipment, supervision and incidentals required to install the pipeline as shown on the Drawings in Lee County Streets by method of open cut.

1.2 SUBMITTAL

- A. Submit shop drawings to the ENGINEER for review.
- B. CONTRACTOR shall adhere to the requirements of Section 01 55 26.
- C. The CONTRACTOR shall engage the services of a Professional Engineer who is registered in the State of Florida to design all cofferdam and sheeting and bracing systems which the CONTRACTOR feels necessary for the execution of his work. The CONTRACTOR's Engineer shall submit to the ENGINEER a signed statement that he has been employed by the CONTRACTOR to design all sheeting and bracing systems. After the systems have been installed, the CONTRACTOR's Engineer shall furnish to the ENGINEER an additional signed statement that the cofferdams and sheeting and bracing systems have been installed in accordance with his design.
- D. If a detour is required, a traffic control plan shall be submitted for approval to Lee County, municipalities and/or the Florida Department of Transportation.
- E. A plan for maintenance of traffic in accordance with Index 600 through 650 of the Florida Department of Transportation Specifications shall be submitted by the CONTRACTOR.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall meet those specified in other applicable portions of this Specification.

PART 3 EXECUTION

3.1 GENERAL

- A. Trench dimensions for open cutting of road crossings are shown on the Drawings.
- B. The CONTRACTOR will be limited to a 24-hour period to complete the open-cut crossing. The road surface shall be repaved, with temporary pavement, if necessary, at the end of the 24-hour period.
- C. The CONTRACTOR shall notify Lee County DOT forty-eight (48) hours in advance of starting construction.

3.2 INSTALLATION

A. Temporary Roadways

- 1. Temporary roadways required for traffic relocation shall be constructed of materials meeting the requirements of the FDOT. Temporary roadways shall be used when crossing a state highway right-of-way or at the direction of the ENGINEER.
- 2. Temporary roadways shall be maintained in good condition throughout their use.
- 3. Drainage shall be maintained through all existing ditches by the use of culvert pipe as necessary.
- 4. Drawings indicating the type and location of temporary roadways shall be submitted as discussed in Paragraph 1.04.C. for approval prior to beginning work.
- 5. Where detours are permitted, the CONTRACTOR shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured, the CONTRACTOR shall expedite construction operations and periods when traffic is being detoured will be strictly controlled by the ENGINEER.
- 6. Lee County DOT will inspect all work being done.
- 7. All work at the roadway crossing shall be performed and completed in a manner fully satisfactory to Lee County DOT.

B. Maintenance of Traffic

- 1. The requirements specified herein are in addition to the plan for Maintenance of Traffic as specified in Sections 01 31 13 and 01 55 26.

2. The CONTRACTOR shall furnish during construction and any subsequent maintenance within State secondary road right-of-ways and Lee County streets, proper signs, signal lights, flagmen, and other warning devices for the protection of traffic all in conformance with the latest Manual on Uniform Traffic Control and Safe Streets and Highways, and the Florida Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations. Information as to the above may be obtained from FDOT Division engineers. The ENGINEER, County Engineer, or FDOT Manager of the right-of-way of their representatives reserves the right to stop any work for non-compliance.
3. The CONTRACTOR shall take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. The CONTRACTOR shall be fully responsible for damage or injuries whether or not police protection has been provided.
4. Unless permission to close a County street is received in writing from the proper authority, all excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the CONTRACTOR's operations cause traffic hazards, he shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the ENGINEER.
5. The CONTRACTOR shall be fully responsible for the installation of adequate safety precautions, for maintenance of the channelization devices, and for the protection of the traveling public.
6. At all open cut crossings, a minimum of one-way traffic shall be maintained during the daylight hours, and two-way traffic at night.

C. Installation of Pipeline

1. Pavement removal, sheeting, shoring and bracing, excavation and backfill, and dewatering shall meet the requirements of the applicable portions of this Specification.
2. The pipe shall be installed in accordance with these Specifications.
3. The trench shall be backfilled in accordance with the requirements of Section 31 23 23.
4. Pavement replacement shall be in accordance with Section 32 10 01 of this Specification

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 33 05 03

LAYING AND JOINTING BURIED PIPELINES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Installation of all underground pipelines. Provide pipeline materials, coatings and linings as specified and pipe of the types, sizes and classes shown or specified.
1. Use proper and suitable tools and appliances for the safe and convenient cutting, handling, and laying of the pipe and fittings.
 2. Use suitable fittings where shown and at connections or where grade or alignment changes require offsets greater than those recommended and approved.
 3. Lay all underground pipelines not supported on piles or concrete cradle in select fill bedding material.
 4. Close off all lines with bulkheads when pipe laying is not in progress.
- B. Related Work Specified in Other Sections Includes:
1. Section 31 23 16 - Excavation - Earth and Rock
 2. Section 31 23 23 - Backfilling
 3. Section 33 05 01 - Leakage Tests
 4. Section 33 11 01 - Polyvinyl Chloride (PVC) Water Main Pipe
 5. Section 33 11 02 - High Density Polyethylene (HDPE) Pipe and Fittings
 6. Section 33 11 12 - Disinfection
 7. Section 33 34 01 - Polyvinyl Chloride (PVC) Force Main Pipe

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
1. ASTM D 2774 - Practice for Underground Installation of Thermoplastic Pressure Piping
 2. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances

3. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile
4. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, C25, 125, 250, 800
5. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
6. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
7. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe With Threaded Flanges
8. ASTM E 165 - Practice for Liquid Penetrant Examination
9. ASTM E 709 - Practice for Magnetic Particle Examination

1.3 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:
- B. Transportation and Delivery: Take every precaution to prevent injury to the pipe during transportation and delivery to the site.
- C. Loading and Unloading: Take extreme care in loading and unloading the pipe and fittings.
 1. Work slowly with skids or suitable power equipment and keep pipe under perfect control at all times.
 2. Under no condition is the pipe to be dropped, bumped, dragged, pushed, or moved in any way that will cause damage to the pipe or coating.
- D. Sling: When handling the pipe with a crane, use a suitable sling around the pipe.
 1. Under no condition pass the sling through the pipe.
 2. Use a nylon canvas type sling or other material designed to prevent damage to the pipe and coating.
 3. When handling reinforced concrete pipe or uncoated steel or ductile iron pipe, steel cables, chain or like slings are acceptable.
- E. Damaged Piping: If in the process of transportation, handling, or laying, any pipe or fitting is damaged, replace or repair such pipe or pipes.

- F. Blocking and Stakes: Provide suitable blocking and stakes installed to prevent pipe from rolling.
 - 1. Obtain approval for the type of blocking and stakes, and the method of installation.
- G. Storage for Gaskets: Store gaskets for pipe joints in a cool place and protect gaskets from light, sunlight, heat, oil, or grease until installed.
 - 1. Do not use any gaskets showing signs of checking, weathering or other deterioration.
 - 2. Do not use gasket material stored in excess of six months without approval.

1.4 FIELD CONDITIONS

- A. Repair of Sanitary Sewers and Services: Rebed, in compacted select fill material, sanitary sewers which cross over the new pipe or which cross under the new pipe with less than 12 inches clear vertical separation. Compact the bedding to densities required for new pipeline construction and extend bedding below the sewer to undisturbed earth. Reconstruct sewers damaged by pipeline construction.
 - 1. Furnish and install all materials and do all work necessary for the reconstruction or repairs of sanitary sewers and services.
 - 2. Provide pipe for reconstruction of sanitary sewers and services meeting the appropriate specification requirements.
 - 3. Provide pipe of the same size as the existing sewer or when the same size is not available, use the next larger size of pipe. Obtain approval of joints made between new pipe and existing pipe.

PART 2 PRODUCTS

- A. The materials allowed for buried sewer pipes are PVC, HDPE or fiberglass. Use of ductile iron pipe is not allowed for sewer construction without specific approval of Lee County Utilities.

PART 3 EXECUTION

3.1 PREPARATION

- A. Dry Trench Bottoms: Lay pipe only in dry trenches having a stable bottom.

1. Where groundwater is encountered, make every effort to obtain a dry trench bottom.
2. If a dry trench bottom has not been obtained due to improper or insufficient use of all known methods of trench dewatering, then the order to excavate below grade and place sufficient select fill material, crushed stone, or 2500 psi concrete over the trench bottom may be given.
3. If all efforts fail to obtain a stable dry trench bottom and it is determined that the trench bottom is unsuitable for pipe foundation, obtain an order, in writing, for the kind of stabilization to be constructed.
4. Perform trench excavation and backfill in accordance with Sections 31 23 16 and 31 23 23.

3.2 INSTALLATION

- A. General: Install all piping in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1. Where pipe deflections are used, do not exceed 80 percent of the maximum deflection limits shown in AWWA C600.
 1. Arrange miscellaneous pipelines, which are shown in diagram form on the Plans, clear of other pipelines and equipment.
- B. Code Requirements: Provide pipeline installations complying with AWWA C600 for iron pipe, AWWA Manual M11 for steel pipe, ASTM D 2774 for thermoplastic pressure piping, and as modified or supplemented by the Specifications.
- C. Pipe Laying - General:
 1. For pipelines intended for gravity flow, begin pipeline laying at the low end of a run and proceed upgrade.
 2. Generally, lay all pipe with bells pointing ahead.
 3. Carefully place each pipe and check for alignment and grade.
 4. Make adjustments to bring pipe to line and grade by scraping away or filling in select fill material under the body of the pipe.
 5. Wedging or blocking up the pipe barrel is not permitted.
 6. Bring the faces of the spigot ends and the bells of pipes into fair contact and firmly and completely shove the pipe home.

7. As the work progresses, clean the interior of pipelines of all dirt and superfluous materials of every description.
8. Keep all lines absolutely clean during construction.
9. Lay pipelines accurately to line and grade.
10. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other material from entering the pipe.

D. Pipe Laying - Trenches:

1. Lay all pipelines in trench excavations on select fill bedding, concrete cradle or other foundations as shown, specified or ordered in writing.
2. Properly secure the pipe against movement and make the pipe joints in the excavation as required.
3. Carefully grade and compact pipe bedding.
4. Bell Holes:
 - a. Cut out bell holes for each joint as required to permit the joint to be properly made and allow the barrel of the pipe to have full bearing throughout its length.
 - b. Thoroughly tamp bell holes full of select fill material following the making of each joint.

E. Other Foundations: Install pipelines laid on other types of foundations as specified for such other foundations or as ordered in writing.

F. Temporary Bulkheads: Provide temporary bulkheads at the ends of sections where adjoining pipelines have not been completed, and in connections built into pipelines where adjoining pipelines or structures have not been completed and are not ready to be connected.

1. Remove bulkheads encountered in connecting sewers or structures included in this Contract, or in pipelines or structures previously built, when they are no longer needed or when ordered.

G. Sleeve Type Couplings: For sleeve type couplings, equally tighten diametrically opposite bolts on the connection so that the gaskets will be brought up evenly all around the pipe.

1. Torque Wrenches: Do the final tightening with torque wrenches set for the torque recommended by the coupling manufacturer.

H. Concrete Encasement: Concrete encasement shall be constructed in accordance with Lee County standard details when:

1. A waterline crosses at a depth which provides less than 18 inches clear distance from sewer lines. Encasement shall extend a minimum 10 feet on each side of the point of crossing. Encase the sewer main unless specifically approved by Lee County Utilities.

2. A waterline running parallel to a sewer line provides less than 10 feet separation. Encase the sewer main unless specifically approved by Lee County Utilities.

3. The Engineer has ordered the line encased.

The points of beginning and ending of pipe encasement shall be not more than 6 inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

I. Jacking:

1. General: Perform jacking as shown. After jacking is completed, seal the ends of the casing pipe with brick masonry.

a. Jacking Pit: Provide jacking pit of adequate length to provide room for the jacking frame, the jacking head, reaction block, the jacks, rig, and jacking pipe.

b. Construct the pit to be sufficiently wide to allow ample working space on each side of the jacking frame and sufficiently deep so that the invert of the pipe will be at the elevation desired for the completed line when placed on the guide frame.

c. Tightly sheet the pit and keep it dry at all times.

d. Provide adequate protective railings at the top of the pit at all times.

2. Jacking Frame: Design the jacking frame so that it applies a uniform pressure over the entire pipe wall area of the pipe to be jacked.

3. Reaction Blocks: Adequately design the reaction blocks to carry the thrust of the jacks to the soil without excessive soil deflection in a manner which avoids any disturbance of adjacent structures or utilities.
4. Hydraulic Jacks: Use hydraulic jacks in the jacking operation and take extreme care to hold the casing pipe to exact line and grade.
5. Advance Excavation: Advance excavation by augering.
6. Casing Pipe: Furnish steel casing pipe, unless otherwise specified, conforming to ASTM A 139 with wall thicknesses and pipe diameters shown on the Plans. Provide full penetration butt welded pipe joints.
7. Fill Material: Use fill material, consisting of 1-1/4 pounds of Bentonite per gallon of water, during jacking to fill any voids between the casing pipe and the earth.

J. Identification:

1. Identification Tape: For all types of pipe to be installed, 3-inch detectable marking tape, of appropriate color, shall be placed along the entire pipe length. In all cases, marking tape shall be installed 12 inches to 18 inches below the finished grade during backfill operations. All PVC pipe, PVC fittings, and identification tape shall be color-coded per standards outlined in the Utility Location and Coordinating Council's Uniform Color Code as specified in Section 4 of the Lee County Utilities Operations Manual.
2. Locating Wire: A locating tracing wire shall also be installed with PVC, HDPE and fiberglass pipes and shall be a continuous No. 12 insulated copper tracing wire laid in the trench on top of the utility pipe and attached to the pipe at ten (10) foot intervals. This continuous tracing wire shall run along the entire pipe and be stubbed out at valves, pressure clean-outs and air release valves.

3.3 FIELD QUALITY CONTROL

- A. Testing: Test pipelines in accordance with Section 33 05 01.
 1. Test valves in place, as far as practicable, and correct any defects in valves or connections.
- B. Inspection: Clean, inspect, and examine each piece of pipe and each fitting and special for defects before it is installed.
 1. Cut away any lumps or projections on the face of the spigot end or the shoulder.

2. Do not use any cracked, broken, or defective pieces in the work.
3. If any defective piece should be discovered after having been installed, remove and replace this piece with a sound piece in a satisfactory manner at no increase in Contract Amount.

3.4 CLEANING

- A. General: Thoroughly clean all pipe before it is laid and keep it clean until it is accepted in the completed work.
- B. Removal of Materials: Exercise special care to avoid leaving bits of wood, dirt, and other foreign particles in the pipe. If any particles are discovered before the final acceptance of the work, remove and clean the pipe.

3.5 DISINFECTION

- A. General: Disinfect all pipelines that are to carry potable water in accordance with Section 33 11 12.

END OF SECTION

SECTION 33 05 24

DIRECTIONAL DRILLING

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. Provide all necessary tools, materials and equipment to successfully complete the installation of directionally, drilled piping as specified herein and shown on the drawings. The CONTRACTOR shall be responsible for the final constructed product, and for furnishing the qualified labor and superintendence necessary for this method of construction.
- B. Furnish all items necessary to perform the horizontal directional drilling operation and construct the pipe to the lines and grade shown on the drawings.
- C. Boring must use techniques of creating or directing a borehole along a predetermined path to a specified target location. This must involve use of mechanical and hydraulic deviation equipment to change the boring course and must use instrumentation to monitor the location and orientation of the boring head assembly along a predetermined course.
- D. Drilling must be accomplished with fluid-assist mechanical cutting. Boring fluids shall be a mixture of bentonite and water or polymers and additives. Bentonite sealants and water will be used to lubricate and seal the mini-tunnel. It is mandatory that minimum pressures and flow rates be used during drilling operation as not to fracture the sub-grade material around and or above the bore.
- E. The mobile drilling system shall utilize small diameter fluid jets to fracture and mechanical cutters to cut and excavate the soil as the head advances forward.
- F. Steering shall be accomplished by the installation of an offset section of drill stem that causes the cutterhead to turn eccentrically about its centerline when it is rotating. When steering adjustments are required, the cutterhead offset section is rotated toward the desired direction of travel and the drill stem is advanced forward without rotation.
- G. The mobile drilling system must be capable of being launched from the surface at an inclined angle and drilling a 2-inch to 3-inch diameter pilot hole. The pilot hole will then be enlarged with reamers as required.

1.2 REFERENCE STANDARDS

- A. Lee County Design Manual

- B. American Association of State Highway and Transportation Officials (AASHTO).
- C. Occupational Safety and Health Administration (OSHA).

1.3 DEFINITIONS

- A. CONTRACTOR's Construction Drawings shall be defined as drawings by which the CONTRACTOR proposes to construct, operate, build, etc., the referenced item. The submission of these drawings shall be required for the sole purpose of providing the sufficient details to verify that the CONTRACTOR's work in progress is in accordance with the intent of the design.

1.4 SUBMITTALS

- A. The ENGINEER will base the review of submitted details and data on the requirements of the completed work, safety of the work in regards to the public, potential for damage to public or private utilities and other existing structures and facilities, and the potential for unnecessary delay in the execution of the work. Such review shall not be construed to relieve the CONTRACTOR in any way of his responsibilities under the contract. CONTRACTOR shall not commence work on any items requiring CONTRACTOR's construction drawings or other submittals until the drawings and submittals are reviewed and accepted by the ENGINEER.
- B. The CONTRACTOR shall:
 - 1. Submit for review complete construction drawings and/or complete written description identifying details of the proposed method of construction and the sequence of operations to be performed during construction, as required by the method of tunnel excavation approved. The drawings and descriptions shall be sufficiently detailed to demonstrate to the ENGINEER whether the proposed materials and procedures will meet the requirements of this specification. CONTRACTOR shall submit arrangement drawings and technical specifications of the machine and trailing equipment (including any modifications), three-year experience record with this type of machine and a copy of the manufacturer's operation manual for the machine.
 - 2. CONTRACTOR's construction drawings shall be submitted on the following items.
 - a. Complete details of the equipment, methods and procedures to be used, including but not limited to primary lining installation, timing of installation in relation to the excavation plan and sequence, bulkheads, etc.

- b. Grouting techniques, including equipment, pumping procedures, pressure grout types, mixtures and plug systems.
 - c. Method of controlling line and grade of excavation.
 - d. Details of muck removal, including equipment type, number, and disposal location.
 - e. Proposed contingency plans for critical phases and areas of directional drilling.
- C. Quality Control Methods. At least 10 days prior to the start of directional drilling, CONTRACTOR shall submit a description of his quality control methods he proposes to use in his operations to the ENGINEER. The submittal shall describe:
- 1. Procedures for controlling and checking line and grade.
 - 2. Field forms for establishing and checking line and grade.
- D. Safety. Procedures including, but not limited to, monitoring for gases encountered shall be submitted.
- E. Hazardous chemical list as well as all MSDS and technical data sheets.
- 1.5 DESIGN CRITERIA
- A. Compatibility of Methods.
- 1. The methods of excavation, lining, and groundwater control shall be compatible.
- 1.6 JOB CONDITIONS
- A. Safety Requirements
- 1. Perform work in a manner to maximize safety and reduce exposure of men and equipment to hazardous and potentially hazardous conditions, in accordance with applicable safety standards.
 - 2. Whenever there is an emergency or stoppage of work which is likely to endanger the excavation or adjacent structures, operate a full work force for 24 hours a day, including weekends and holidays, without intermission until the emergency or hazardous conditions no longer jeopardize the stability and safety of the work.
- B. Air Quality.

1. Conduct directional drilling operations by methods and with equipment, which will positively control dust, fumes, vapors, gases or other atmospheric impurities in accordance with applicable safety requirements.

1.7 PERMITS

- A. Obtain any and all other permits required for prosecution of the work.

PART 2 PRODUCTS

2.1 GENERAL

- A. Refer to Section 33 11 02 for HDPE pipe material.

PART 3 EXECUTION

3.1 GENERAL

- A. The CONTRACTOR shall be responsible for his means and methods of directional drilling construction and shall ensure the safety of the work, the CONTRACTOR's employees, the public, and adjacent property, whether public or private.
- B. Anticipate that portions of the drilled excavation will be below the groundwater table.
- C. Comply with all local, state and federal laws, rules and regulations at all times to prevent pollution of the air, ground and water.

3.2 EQUIPMENT

- A. Diesel, electrical, or air-powered equipment will be acceptable, subject to applicable federal and state regulations.
- B. Any method or equipment that the CONTRACTOR can demonstrate will produce the specified results will be considered.
- C. Employ equipment that will be capable of handling the various anticipated ground conditions. In addition, the equipment shall:
 1. Be capable of minimizing loss of ground ahead of and around the machine and providing satisfactory support of the excavated face at all times.

2. Provide a system to indicate whether the amount of earth material removed is equivalent to that displaced by the advance of the machine such that the advance rate may be controlled accordingly.
- D. Provide adequate secondary containment for any and all portable storage tanks.

3.3 DIRECTIONAL DRILLING DATA

- A. Daily logs of construction events and observations shall be submitted on at least the following:
1. Location and elevation of significant soil strata boundaries and brief soil descriptions.
 2. Jacking pressures and torsional forces, if applicable.

3.4 CONTROL OF THE TUNNEL LINE AND GRADE

- A. Construction Control.
1. Establish and be fully responsible for the accuracy of his own control for the construction of the entire project, including structures, tunnel line and grade.
 2. Establish control points sufficiently far from the tunnel operation not to be affected by construction operations.
 3. Maintain daily records of alignment and grade and shall submit three copies of these records to the ENGINEER. However, the CONTRACTOR remains fully responsible for the accuracy of his work and the correction of it, as required.
 4. Check control for the bore alignment against an above ground undisturbed reference at least once each hour and once for each 50 feet of tunnel constructed, or more often as needed or directed by the ENGINEER.

3.5 DISPOSAL OF EXCESS MATERIAL

- A. Where such effort is necessary, cost for groundwater control during the course of the tunnel work shall be included in the unit contract price for the work.
- B. Dewatering required during the course of the project to lower water table, to remove standing water, surface drainage seepage, or to protect ongoing work against rising waters or floods shall be considered incidental to the work being performed.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 33 11 01

POLYVINYL CHLORIDE (PVC) WATER MAIN PIPE

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required, and install polyvinyl chloride (PVC) waterline, fittings, service connections and appurtenances as shown on the Drawings and as specified herein.
- B. All water mains less than or equal to 12 inches in diameter shall be constructed of PVC, unless otherwise approved by Lee County Utilities.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. This standard references the documents listed below. They form a part of this standard to the extent specified herein. In any case of conflict, the requirements of this standard shall prevail.
 - 1. ASTM D1598 - Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.
 - 2. ASTM D1599 - Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings.
 - 3. ASTM D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 4. ASTM A252 - Standard Specification for Welded and Seamless Steel Pipe Piles.
 - 5. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 - 7. ASTM 2737 - Standard Specification for Polyethylene (PE) Plastic Tubing.
 - 8. ASTM D3139 - Specifications for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

9. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
10. AWWA C110 - Ductile-Iron and Gray-Iron Fittings for Water.
11. AWWA C153 - Ductile-Iron Compact Fittings

1.3 SUBMITTAL

- A. Submit to the Engineer within fourteen days after receipt of Notice-to-Proceed a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.
- B. Submit for approval, as provided in the Supplement to the General Conditions, complete, detailed shop drawings of all PVC pipe and fittings.
- C. Submit and shall comply with pipe manufacturer's recommendations for handling, storing, and installing pipe and fittings.

PART 2 PRODUCTS

2.1 WATER MAIN

- A. Polyvinyl Chloride (PVC) Pipe
 1. All 4-inch through 12-inch diameter PVC pipe shall be rated per AWWA, C900, DR18, Class 150. Water mains larger than 12 inches shall be constructed of Ductile Iron Pipe.
 2. PVC pipe less than 4-inches in diameter shall be Schedule 80 with a pressure rating of 200 psi solvent welded, including blow-off assemblies. PVC pipe will be acceptable for pipe diameters of 12 inches or less.
 3. The potable water mains shall be blue in color.
 4. All pipe shall be manufactured in the United States.
- B. Steel Encasement Pipe: Conform to ASTM Designation A252, Grade 2. Joints shall be welded completely around the pipe by a certified welder. Pipe shall meet all AASHTO standards and Florida DOT requirements.
- C. Fittings:
 1. PVC Pipe: Fittings shall be ductile iron mechanical joint, with a working pressure of 250 psi and conforming to AWWA Specifications C110 or C153.

2. Acceptable manufactures of fittings can be found in the LCU Approved Materials List.
 3. All fittings shall be manufactured in the United States.
- D. Joint Restraining Devices: Restraining joints shall be placed at all bends, tees, plugs, reducers, and other fittings to provide lateral support, and shall conform to the details shown on the drawings in Section 9 of the Lee County Utilities Operations Manual. Concrete thrust blocks may be utilized as additional restraint if approved by Lee County Utilities.
1. See the LCU Approved Materials List for Joint restraint devices for C-900 PVC pipe used with ductile iron mechanical joint fittings, Bell joint restraint devices for PVC push joint pipe, and restraints for C-900 PVC fittings.
 2. Bolts and nuts shall be Ductile Iron, T-Head type with hexagonal nuts. Bolts and nuts shall be machined through, and nuts shall be tapped at right angles to a smooth bearing surface.
- E. Joint Design: PVC pipe 4 inches in diameter or larger shall have provisions for expansion and contraction provided in the joints. All joints shall be designed for push- on make-up connections. Push-on joint may be a coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross section, similar and equal to John's Mannville ring-type and Ethyl Bell Ring or may be made with a separate twin gasketed coupling similar and equal to Certainteed Fluid-Type.

2.2 IDENTIFICATION

- A. Pipe shall bear identification markings that will remain legible after normal handling, storage, and installation. Markings shall be applied in a manner that will not weaken or damage the pipe. Marking shall be applied at intervals of not more than 5 feet on the pipe. Marking on the pipe shall include the following:
1. Nominal size and OD base.
 2. PVC
 3. Dimension ration
 4. AWWA pressure rating.
 5. AWWA designation.

6. Manufacturer's name and trademark.
7. Manufacturer's production code, including day, month, year, shift, plant, and extruder of manufacturer.
8. All PVC water pipe shall be color-coded blue.

PART 3 EXECUTION

3.1 WATER MAIN INSTALLATION

- A. Polyvinyl Chloride (PVC) water pipe shall be installed in accordance with the manufacturer's recommendation, as shown on the drawings, and as specified herein.
- B. The Contractor shall use care in handling, storage, and installation of pipe and fittings. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's recommendation. Under no circumstances shall pipe or fittings be dropped into the trench.
- C. Pipe shall be laid to lines and grade shown on the drawings with bedding and backfill as shown on the drawings. Blocking under the pipe will not be permitted.
- D. When laying is not in progress, or the potential exists for dirt or debris to enter the pipe, the open ends of the pipe shall be closed with plug or by other approved means.

3.2 SERVICE CONNECTIONS

- A. All potable service taps shall be located in open/green areas unless specifically approved by Lee County Utilities. Any service taps that are approved within a paved area, a 2-inch cast iron body gate valve shall be used in lieu of a corporation stop.
- B. Service connections shall be installed at the locations and in the manner shown on the Drawings.
- C. Service clamps for PVC mains shall be full-circle bearing types as shown on the details in Section 6 of the Lee County Utilities Operations Manual.
- D. Corporation stops and curb stops shall be fitted with a compression connection outlet with split-lock devices for polyethylene or copper pipe.
- E. On curbed streets the exact location for each installed service shall be marked by etching or cutting a "W" in the concrete curb; where no curb exists or is planned, locations shall be adequately marked by a method approved by Lee County

Utilities.

- F. Service connection shall not be installed on pipelines 16 inches and larger unless extenuating conditions exist and said connection is approved by Lee County Utilities.
- G. When practical, in new residential, commercial, or/and industrial subdivisions, the corporation stop shall be located at the intersecting property line or in the center of the lot.
 - 1. Copper Pipe Copper pipe for 3/4-inch to 1-inch service line installations shall be American manufactured, Type K, and conform to the requirements of ASTM designation B88. Brass compression couplings with screw-clamp fittings shall be used with copper pipe.
 - 2. Polytubing Polyethylene Tubing will be acceptable in sizes from 1-1/2 inches to 2 inches in diameter. Tubing for service lines shall be of a type approved by the National Sanitation Foundation for use in transmitting fluids for human consumption. The tubing shall be designed for a minimum burst pressure of 630 psi for water at 23°C and shall be manufactured in accordance with the requirements of ASTM D2737 and shall be blue in color.

3.3 CLEANING

- A. At the conclusion of the work, the Contractor shall thoroughly clean all of the new pipelines by flushing with water and pigged to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the job site. If, after this cleaning, any obstructions remain, they shall be removed at the Contractor's expense.

3.4 TESTING AND DISINFECTION

- A. Test completed water pipeline in accordance with Section 33 05 01. Disinfect completed water pipeline in accordance with Section 33 11 12.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 33 11 02

HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required to install High Density Polyethylene (HDPE) pressure pipe, fittings, and appurtenances as shown on the Drawings and specified in the Contract Documents.
- B. High Density Polyethylene (HDPE) – Lee County Utilities has the option of approving the use of HDPE for water main crossings of roadways, ditches, canals, and environmentally sensitive lands. HDPE water mains shall have the same equivalent internal diameter and equivalent pressure class rating as the corresponding PVC pipe, unless otherwise approved by Lee County Utilities. For all roadway crossings refer to the design manual for casing requirements. The Department of Transportation having jurisdiction of said road and right-of-way must grant specific approval.

1.2 REFERENCED STANDARDS

- A. All standard specifications, i.e., Federal, ANSI, ASTM, etc., made a portion of these Specifications by reference, shall be the latest edition and revision thereof.

1.3 QUALIFICATIONS

- A. All HDPE pipe, fittings, and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the items to be furnished.

1.4 SUBMITTALS

- A. Submit to the ENGINEER, a list of materials to be furnished, the names of the suppliers, and the appropriate shop drawings for all HDPE pipe and fittings.
- B. Submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.
- C. Submit shop drawings showing installation method and the proposed method and specialized equipment to be used.

1.5 INSPECTIONS AND TESTS

- A. All work shall be inspected by an Authorized Representative of the OWNER who shall have the authority to halt construction if, in his opinion, these specifications or standard construction practices are not being followed. Whenever any portion of these specifications is violated, the ENGINEER or his authorized representative, shall, by written notice, order further construction to cease until all deficiencies are corrected.

1.6 WARRANTY AND ACCEPTANCE

- A. Warrant all work to be free from defects in workmanship and materials for a period of one year from the date of completion of all construction. If work meets these specifications, a letter of acceptance, subject to the one-year warranty period, shall be given at the time of completion. A final acceptance letter shall be given upon final inspection at the end of the one-year warranty period, provided the work still complies with these specifications. In the event deficiencies are discovered during the warranty period, they shall be corrected by the CONTRACTOR without additional charge to the OWNER before final acceptance. During the warranty period, the ENGINEER shall determine if warranty repairs or replacement work shall be performed by the CONTRACTOR. The decision of the ENGINEER shall be binding upon the CONTRACTOR.

PART 2 PRODUCTS

2.1 POLYETHYLENE PIPE AND FITTINGS

- A. Products supplied under this section assume that petroleum products or organic solvents will not be encountered. If during the course of pipe installation the Contractor identifies or suspects the presence of petroleum products or any unknown chemical substance, stop installing piping in the area of suspected contamination until direction is provided by the EOR.
- B. All materials which come in contact with water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.
- C. Polyethylene pressure pipe shall be manufactured from PE3408 polyethylene and shall meet AWWA C906 standards. The nominal pipe diameter is specified on the Contract Drawings. The DR and the pressure rating of the pipe shall be as noted on the plans.
- D. Where HDPE pipe is joined to HDPE pipe, it shall be by thermal butt fusion. Thermal fusion shall be accomplished in accordance with the pipe manufacturer and fusion equipment supplier specifications. The CONTRACTOR installing

thermal butt fused HDPE pipe shall have a minimum of five years experience performing this type of work.

- E. Qualification of Manufacturer: The Manufacturer shall have manufacturing and quality control facilities capable of producing and assuring the quality of the pipe and fittings required by these specifications. The Manufacturer's production facilities shall be open for inspection by the OWNER or his authorized representative. Qualified manufacturers shall be approved by the OWNER.
- F. Approved Manufacturer: Manufacturers that are qualified and approved are listed in the LCU Approved Materials List.
- G. Materials: Materials used for the manufacture of polyethylene pipe and fittings shall be PE3408 high density polyethylene meeting cell classification 345434C or 345434E per ASTM D 3350; and shall be listed in the name of the pipe and fitting manufacturer in PPI (Plastics Pipe Institute) TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade rating of 1600 psi at 73°F. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.
- H. Sections of the pipe having been discovered with cuts or gouges in excess of 10% of the pipe wall thickness shall be cut out and removed. The undamaged portions of the pipe shall be rejoined by butt fusion.
- I. The pipe shall contain no recycled compound except for rework material generated in the manufacturer's own plant that has the same cell classification as the material to which it is being added.
- J. Interchangeability of Pipe and Fittings: Polyethylene pipe and fittings shall be produced by the same Approved Manufacturer. Products made by subcontractor's or Manufacturer's distributor are not acceptable. Pipe and fittings from different Approved Manufacturers shall not be interchanged.
- K. Polyethylene Pipe: Polyethylene pipe shall be manufactured in accordance with ASTM F 714, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter or ASTM D 3035, Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter and shall be so marked. Each production lot of pipe shall be tested for (from material or pipe) melt index, density, % carbon, (from pipe) dimensions and either quick burst or ring tensile strength (equipment permitting).

- L. Color Identification: HDPE must have at least three equally spaced horizontal colored marking stripes. Permanent identification of piping service shall be provided by adhering to the following colors (in accordance with the coloring code in Section 09 90 00).

Blue – raw water
Blue – potable water
Green – wastewater, sewage
Pantone Purple – reuse or reclaimed water

- M. Polyethylene Fittings and Custom Fabrications: Polyethylene fittings and custom fabrications shall be molded or fabricated by the pipe manufacturer. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Pressure de-rated fabricated fittings are prohibited.
- N. Molded Fittings: Molded fittings shall be manufactured in accordance with ASTM D 3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing, and shall be so marked. Each production lot of molded fittings shall be subjected to the tests required under ASTM D 3261.
- O. Fabricated Fittings: Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service equivalent to the full service pressure rating of the mating pipe. Directional fittings 16" IPS and larger such as elbows, tees, crosses, etc., shall have a plain end inlet for butt fusion and flanged directional outlets. Part drawings shall be submitted for the approval of the ENGINEER.
- P. Polyethylene Flange Adapters: Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to provide gasketless sealing, or to restrain the gasket against blow-out.
- Q. Back-up Rings and Flange Bolts: Flange adapters shall be fitted with lap joint flanges pressure rated equal to or greater than the mating pipe. The lap joint flange bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.

2.2 MANUFACTURER'S QUALITY CONTROL

- A. The pipe and fitting manufacturer shall have an established quality control program responsible for inspecting incoming and outgoing materials. Incoming

polyethylene materials shall be inspected for density, melt flow rate, and contamination. The cell classification properties of the material shall be certified by the supplier and verified by Manufacturer's Quality Control. Incoming materials shall be approved by Quality Control before processing into finished goods. Outgoing materials shall be checked for:

- Outside diameter, wall thickness, and eccentricity as per ASTM D2122 at a frequency of at least once/hour or once/coil, whichever is less frequent.
- Out of Roundness at frequency of at least once/hour or once/coil, whichever is less frequent.
- Straightness, inside and outside surface finish, markings and end cuts shall be visually inspected as per ASTM F714 on every length of pipe.

2.3 COMPLIANCE TESTS

- A. In case of conflict with Manufacturer's certifications, the CONTRACTOR, ENGINEER, or OWNER may request re-testing by the manufacturer or have re-tests performed by an outside testing service. All re-testing shall be at the requestor's expense and shall be performed in accordance with the Specifications.
- B. Installation shall be in accordance with Manufacturer's recommendations and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with the applicable codes and standards.

PART 3 EXECUTION

3.1 INSTALLATION OF HIGH DENSITY POLYETHYLENE PRESSURE PIPE AND FITTINGS

- A. All high density polyethylene (HDPE) pressure pipe shall be installed by direct bury, directional bore, or a method approved by the OWNER/ENGINEER prior to construction. If directional bore is used, or if directed by the OWNER/ENGINEER, the entire area of construction shall be surrounded by silt barriers during construction.

Installation shall be in accordance with Manufacturer's recommendations, and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with the applicable codes and standards.

- B. All pipe shall be installed in accordance with AWWA M55. All contractors and inspectors shall be trained and certified by the manufacturer prior to installing the HDPE pipe. A copy of the training certification and proof of insurance shall be provided to the EOR before any work shall commence.

- C. Remove all dirt and foreign matter from pipe before lowering into the trench. Do not place debris, hand tools, clothing, or other materials in the pipe. Keep pipe clean during and after laying.
- D. Maximum pipe bending radius shall be in conformance with the manufacturer's recommendation for the specific diameter and dimension ratio (DR) of the pipe. Whenever possible, changes in direction shall be accomplished by bending the pipe in lieu of installing a fitting, except as approved by the EOR.
- E. Place tracer wire (if required) immediately above the initial backfill material, directly over the pipe. The wire shall be contiguous except at test stations, valve vaults, and where splicing is required. All splices shall be encased. Wire insulation shall be highly resistant to alkalis, acid and other destructive agents found in soil.
- F. Prevent flotation of sealed pipe during work stoppages.
- G. HDPE pipe will not be employed with directional drilling through rock and other abrasive conditions unless it is encased.

3.2 HEAT FUSION JOINING

- A. Joints between plain end pipes and fittings shall be made by butt fusion, and joints between the main and saddle branch fittings shall be made using saddle fusion using only procedures that are recommended by the pipe and fitting Manufacturer. Ensure that persons making heat fusion joints have received training and certification for heat fusion in the Manufacturer's recommended procedure. Maintain records of trained personnel and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.
- B. Each HDPE joint shall be traceable to the fusion operator and equipment. Also, the fusion joint number and fusion operator ID shall be stenciled on the pipe.

3.3 MECHANICAL JOINING

- A. Polyethylene pipe and fittings may be joined together or to other materials by means of flanged connections (flange adapters and back-up rings). Mechanical couplings will not be approved.
- B. Each HDPE joint shall be traceable to the fusion operator and equipment. Also, the fusion joint number and fusion operator ID shall be stenciled on the pipe.

3.4 BRANCH CONNECTIONS

- A. Branch connections to the main shall be made with saddle fittings or tees.

3.5 EXCAVATION

- A. Trench excavations shall conform to this specification, Section 31 23 16, the plans and drawings, as otherwise authorized in writing by the ENGINEER or his approved representative, and in accordance with all applicable codes. Excess groundwater shall be removed by the CONTRACTOR. Where necessary, trench walls shall be shored or reinforced.

3.6 LARGE DIAMETER FABRICATED FITTINGS

- A. Fabricated directional fittings 16" IPS and larger shall be butt fused to the end of a pipe. The flanged directional outlet connections shall be made up in the trench.

3.7 MECHANICAL JOINT AND FLANGE INSTALLATION

- A. Mechanical joints and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. Flange faces shall be centered and aligned to each other before assembling and tightening bolts. In no case shall the flange bolts be used to draw the flanges into alignment. Bolt threads shall be lubricated, and flat washers shall be fitted under the flange nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least one hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be 100 ft-lbs or less as recommended by the Manufacturer.

3.8 FOUNDATION AND BEDDING

- A. Pipe shall be laid on grade and on a stable foundation in accordance with Section 31 23 23.

3.9 PIPE HANDLING

- A. When lifting with slings, only wide fabric choker slings shall be used to lift, move, or lower pipe and fittings. Wire rope or chain shall not be used. Slings shall be of sufficient capacity for the load and shall be inspected before use. Worn or defective equipment shall not be used. The Subcontractor shall perform visual examination of HDPE piping installations to satisfy that they conform to the applicable assembly and erection requirements including: alignment, routing, elevation, cuts/gouges exceeding 10% of wall thickness, flanged joints, bolting torque, bolt length, gaskets, and supports (if applicable).

3.10 TESTING

- A. Butt Fusion Testing: On every day butt fusions are to be made, the first fusion of the day shall be a trial fusion. The trial fusion shall be allowed to cool completely, then fusion test straps shall be cut out. The test strap shall be 12 inches (min) or 30 times the wall thickness in length with the fusion in the center, and 1 inch (min) or 1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new trial fusion shall be made, cooled completely, and tested. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.

Perform all butt fusion joints in the presence of the ENGINEER or his representative. Record the temperature and corresponding time for each fusion joint.

- B. Hydrostatic Pressure Testing: HDPE pipes shall be pressure tested in a similar manner as for PVC force main in accordance with Section 33 05 01.

3.11 INCLEMENT WEATHER

- A. In inclement weather and especially in windy conditions, the fusion operation shall be shielded to avoid precipitation and excessive heat loss from wind chill.
- B. The time required to obtain the proper melt may increase when fusing in cold weather. Subcontractor shall maintain the specified heating tool surface temperature during the fusion process.
- C. The proper cycle time for any particular condition shall be determined by making a melt pattern on a piece of scrap HDPE pipe using the recommended standard heating time. If the melt pattern is incomplete, the Subcontractor shall increase the heating time by three (3) second intervals until a complete melt pattern is established. Each time the procedure is repeated, a new piece of scrap pipe shall be used.

END OF SECTION

SECTION 33 11 12

DISINFECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Disinfection of all pipelines, tanks, structures, conduits and equipment which are to store, handle or carry potable water. Furnish all labor, water, chemicals and equipment, including taps, corporation stops, temporary pumps and other items necessary to perform the Work, except as otherwise specified.

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. AWWA C651 - Disinfecting Water Mains
 - 2. AWWA C652 - Disinfection of Water-Storage Facilities
 - 3. AWWA C654 - Disinfection of Wells

1.3 QUALITY ASSURANCE

- A. Disinfection Standards: Disinfect in accordance with AWWA C651 for water mains and AWWA C652 for water storage facilities and equipment and AWWA 654 for wells.
- B. Chlorinated Water Disposal: Dispose of old highly chlorinated water in accordance with applicable regulations.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 WATER MAIN DISINFECTION

- A. Following acceptable pressure testing, disinfect all sections of the water distribution system and receive approval thereof from the appropriate agencies, prior to placing in service. Advance notice of 24 hours shall be provided to the

COUNTY before disinfecting procedures start. The disinfection shall be accomplished in accordance with the applicable provisions of AWWA Standard C601, "Disinfecting Water Main" and all appropriate approval agencies.

- B. The disinfecting agent shall be free chlorine in aqueous solution with sustained concentration for 12 hours or more of not less than 50 parts per million. Chlorine maybe derived from Chlorine gas, or 70% (high test) calcium hypochlorite (HTH or Perchloron, or equal). Administration may be by any of the several methods described in AWWA Standard C601 as proposed by the CONTRACTOR and approved by the ENGINEER. Proposals as to method must be made prior to commencement of the disinfection process.
- C. Following contact with chlorine solution, the system shall be thoroughly flushed out. Samples shall then be taken using sterile containers obtained from the County Health Department. Samples shall be taken by the CONTRACTOR and delivered by him to the County Health Department or approved laboratory for analysis.
- D. If samples do not demonstrate satisfactory results, the disinfection procedure shall be repeated until two series of satisfactory samples are obtained, the period between such series of samples to be a minimum of 24 hours.

3.2 DISINFECTON PROCEDURES FOR TANKS

- A. Disinfect potable water storage tanks and equipment in accordance with AWWA C652, Method 2 or 3, using sodium hypochlorite.
 - 1. In Method 2, spray method, spray the entire interior surface of the tank with chlorinated water containing 200 mg/l of available chlorine. After spraying, allow the tank to stand at least two hours before filling with fresh water.
- B. After disinfection, allow the tanks and equipment to overflow until the chlorine residual is approximately 2 mg/l.

3.3 DISINFECTON PROCEDURES FOR WELLS

- A. The CONTRACTOR shall disinfect wells in accordance with AWWA A100-97 Section 4.9 Well Disinfection using the procedures described in ANSI/AWWA C654. The CONTRACTOR shall perform sampling on two consecutive days, no less than 24 hours apart and demonstrate satisfactory results for both samples.

END OF SECTION

SECTION 33 34 01

POLYVINYL CHLORIDE (PVC) FORCE MAIN PIPE

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required, and install polyvinyl chloride (PVC) force main pipe, fittings, and appurtenances as shown on the drawings and as specified herein.

1.2 SUBMITTALS

- A. Submit to the ENGINEER within fourteen calendar days after receipt of Notice-to-Proceed a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.
- B. Submit for approval, as provided in the General Conditions, complete, detailed shop drawings of all PVC pipe and fittings.
- C. Submit and shall comply with pipe manufacturer's recommendations for handling, storing, and installing pipe and fittings.

PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. Unless otherwise shown on the Drawings or specified, PVC force main pipe shall meet the following minimum requirements:
 - 1. For PVC pipe not installed under roadway pavement:
 - a. Pipe 4 inches through 24 inches in diameter shall be DR18, AWWA C-900.
 - b. Pipe greater than 24 inches in diameter shall be DR25, AWWA C900.
 - 2. For PVC pipe installed under roadway pavement by direct burial:
 - a. Pipe 4 inches through 12 inches in diameter shall be DR14, AWWA C-900
 - b. Pipe 14 inches through 24 inches in diameter shall be DR14, AWWA-C905.

- c. Pipe greater than 24 inches in diameter shall be DR25, AWWA C-900.
- B. PVC fittings 4 inches and larger in diameter shall meet the requirements of applicable AWWA C900 and C905 specifications. Fittings shall be manufactured entirely of PVC meeting ASTM D1784, shall be formed by a thermal-form process and be of one-piece construction, able to withstand 755 psi quick burst pressure-tested in accordance with ASTM D1599 and withstand 500 psi for a minimum of 1,000 hours tested in accordance with ASTM D1598. Bells shall be gasketed push on type conforming to ASTM D3139 with gaskets conforming to ASTM F477. Approved fittings are listed in the LCU Approved Materials List. Ductile iron fittings with mechanical or push on joints conforming to AWWA C153 or C110 may be approved as alternative when PVC pressure fittings of the required sizes are not available. If ductile iron fitting is used, the fitting shall have a fusion bonded epoxy coating to a minimum of 20 mil thickness.
- C. Pipe shall be homogeneous throughout. It shall be free from voids, inclusions, and other defects. Pipe surface shall be free from nicks and scratches, joining surfaces of spigots and joints shall be free from gouges and imperfections that could cause leakage.
- D. All joints shall be made in accordance with the manufacturer's recommendations. The particular joint used shall be approved by Lee County Utilities prior to installation. No sulfur-based compounds shall be used.
- E. Pipe shall be furnished in standard laying lengths not exceeding 20 feet.
- F. Restrained joints shall be provided at all tees, plugs, horizontal bends, vertical offsets, and locations shown on the drawings. See the LCU Approved Materials List for Joint restraint devices for C-900 PVC pipe used with ductile iron mechanical joint fittings, Bell joint restraint devices for PVC push joint pipe, and restraints for C-900 PVC fittings. Bolts and nuts shall be Ductile Iron or 300 Series Stainless Steel, T-Head type with hexagonal nuts. Bolts and nuts shall be machined through, and nuts shall be tapped at right angles to a smooth bearing surface. Restraints shall be Class 150 psi and shall be capable of withstanding 300 psi quick burst test without separation or failure. Suitable PVC/ductile iron adapters shall be provided as necessary.
- G. PVC pipe fittings for 2-inch and smaller diameter pipe shall be glued and shall be Schedule 80 and conform to the requirements of ASTM D-2464. Threaded joints can be used with PVC Schedule 80 pipe or stronger with diameters larger than 2 inches. At threaded joints between PVC and metal pipes, the metal shall contain a threaded socket end and the PVC threaded spigot end. A metal spigot shall not under any circumstances, be screwed into a PVC socket.

2.2 IDENTIFICATION

- A. Pipe shall bear identification markings that will remain legible after normal handling, storage, and installation. Markings shall be applied in a manner that will not weaken or damage the pipe. Marking shall be applied at intervals of not more than 5 feet on the pipe. Marking on the pipe shall include the following:
- B. Nominal size and OD base.
- C. PVC.
- D. Dimension ratio.
- E. AWWA pressure rating.
- F. AWWA designation.
- G. Manufacturer's name or trademark.
- H. Manufacturer's production code, including day, month, year, shift, plant, and extruder of manufacture.
- I. All PVC sewage force main pipe shall be color coded green.

2.3 STRUCTURE AND MANHOLE CONNECTIONS

- A. Pipe stubs for all structure and manhole connections shall not exceed 12 inches in length unless otherwise shown on the drawings. Caps shall be furnished where required.

PART 3 EXECUTION

3.1 INSTALLATION

- A. PVC force main pipe shall be installed in accordance with the manufacturer's recommendation, as shown on the Drawings, and as specified herein.
- B. Use care in handling, storage, and installation of pipe and fittings. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's recommendation. Under no circumstances shall pipe or fittings be dropped into the trench.
- C. Pipe shall be laid to lines and grade shown on the Drawings with bedding and backfill as shown on the Drawings and as specified in Section 31 23 23. Blocking under the pipe will not be permitted.

- D. When laying is not in progress, or the potential exists for dirt or debris to enter the pipe, the open ends of the pipe shall be closed with plug or by other approved means.
- E. In all cases where PVC pipe is installed, a marking tape shall be located above the top of the pipe as specified in Section 33 05 03.

3.2 TESTING FORCE MAINS

- A. Test force mains for leakage in accordance with Section 33 05 01.

END OF SECTION

SECTION 33 35 00

ALUM FEED SYSTEM PIPING, VALVES, AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope of Work

1. The Contractor shall furnish and install all piping, fittings, valves and related materials for all alum suction, discharge and return lines, and pH monitoring lines required for an operable alum feed system.
2. The Contractor shall coordinate the type of materials and installation procedures with the Alum Feed System equipment specified in these Technical Provisions. Connections to the Alum Feed System shall be made per manufacturer's recommendations.
3. The location of the piping, fittings, and valves shall include the alum feed building and to all remote alum feed locations.
4. Materials under this section shall include, but is not limited to, the following:
 - a. Alum suction lines
 - b. Alum discharge lines
 - c. Alum return lines
 - d. Fittings
 - e. Valves
 - f. Pressure gauges
 - g. Calibration chamber
5. All components that are subjected to corrosion shall be constructed of chemical and corrosion resistant materials and coatings.
6. The entire system shall comply with all applicable OSHA rules and regulations
7. All construction shall conform to the requirements of the Trench Safety Act, Florida Statutes 90-96.

1.2 QUALIFICATIONS

- A. The materials shall be products of a manufacturer who is fully experienced, reputable, and qualified in the manufacturer of chemical feed materials. The materials shall be designed, constructed, delivered, and installed in accordance with the best practices and methods.
- B. The system(s) shall be furnished by a single supplier who shall coordinate the system design for the proper operation of each system. The alum feed system(s) shall be supplied and assembled by Technical Solutions Inc., 117 Morningside Drive, Lakeland, FL, 33803, (863) 683-5371; or approved equal. Approved equal shall have demonstrated experience with a minimum of 10 previous projects, each of which include stormwater flow sensing, alum pumping systems for stormwater treatment, and related instrumentation. Experience with potable or wastewater systems will not be considered equivalent. The EOR shall have sole determination on the acceptability of the approved equal. Any request for an approved equal shall be made during the bid process, prior to bid submittal/opening; alternate supplier requests will not be accepted after contract award.

1.3 SUBMITTALS

A. Materials and Shop Drawings

Copies of all materials required to establish compliance with these specifications shall be submitted in accordance with the provisions of the Contract Documents. Submittals shall include at least the following:

1. Certified shop and erection drawings showing all piping, fittings, valves, and related appurtenances within the building and FRP alum storage tank area.
2. Descriptive literature bulletins and or catalog of each item to be furnished and installed.
3. A statement from the manufacturer that all supplied material is suitable for use with liquid alum, $Al_2(SO_4)_3 \cdot 14 H_2O$.

B. Additional Information

1. In the event that it is impossible to conform with certain details of the specifications, describe completely all non-conforming aspects.
2. Provide materials warranty per specifications.

3. All operating and maintenance instructions shall be furnished to the OWNER's Representative.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the installation offered. They are, however, intended to cover the furnishing, delivery, installation, and field testing of all materials, and apparatus as required. Any additional materials necessary for the proper operation of the proposed installation not mentioned in these Specifications or shown on the Drawings shall be furnished and installed.
- B. The material covered by these Specifications is intended to be of proven ability and as manufactured by reputable concerns having experience in the production of such materials. The materials furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.
- C. All materials shall be designed and proportioned to have liberal strength, stability, and stiffness and to be specially adapted for the intended service.
- D. All piping and appurtenances shall be rigidly and accurately anchored into position and all necessary foundation bolts, plates, nuts, and washers shall be furnished and installed. All bolts, nuts, and washers shall be of stainless steel.
- E. Engraved laminated nameplates giving the name and function of all piping, valves, and pump shall be securely attached to each in a conspicuous location.

2.2 MATERIALS

- A. Alum Discharge Line, Alum Suction Line, and Alum Return Line:
 1. All pipe, fittings and valves in the building and at the point of alum addition structure shall be gray (same color) solvent welded Schedule 80 polyvinyl chloride (PVC), unless otherwise noted on the drawings. Use only solvent cement and primer rated for Schedule 80 PVC.
 2. All piping outside the building and point of alum addition structure shall

be as indicated on the Construction Drawings.

B. Valves: Hayward or approved equal

1. The valve shall be designed to operate with the chemical solutions being pumped.
2. All valve bodies shall be PVC, Type 1, Grade 1, unless otherwise noted on the drawings.
3. The valve diaphragm shall be made of an elastomer (Hypalon) bonded to TFE facing.
4. Ball valves shall be manually operated with a Teflon seat.
5. Check valves shall be spring compression operated with Hypalon disc.
6. Butterfly valve stems shall be 316 stainless steel and provide full engagement over length of disk.
7. Valve actuators shall be electric and manufactured by Hayward or approved equal. Enclosure shall be rated to NEMA 4X with a powder coated aluminum alloy housing. Manual override capability shall be provided via a hand wheel. Actuator shall include a visual position indicator and include a three year warranty.

C. Pipe Hanger: Anchors and pipe hangers shall be 316 stainless steel. Hangers shall allow for a 2" wall offset.

D. Camlock Fittings: 316 Stainless Steel

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All materials shall be installed in strict conformance with the manufacturer's instructions and recommendations.
- B. All pipe, fittings, and valves within the building shall be properly anchored and/or supported and direction of flow indicated. Separate colors will be used to identify power lines versus alum lines.
- C. All pipes within the control building or vault will be labeled with description, i.e. alum suction line, alum discharge line, alum return line, water line, power line

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and direction of flow in large pre-printed labels.

- D. All piping outside the vault shall have a continuous labeled metallic locating tape placed 12" above the line.

3.2 TESTING

All lines will be hydrostatically tested as described in 33 05 01.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 43 01 00
ALUM FEED SYSTEM AND INSTRUMENTATION
COMPONENTS AND CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope

1. Furnish and install, complete with all accessories, a programmable logic control-based monitoring and control system with its associated instrumentation as described herein and shown on the contract drawings. The system shall serve as a self-contained monitoring and control system for all aspects of the pump station operation.
2. This Specification has been developed to establish minimum requirements for a pump controller. This system shall be designed, constructed, tested and documented in strict accordance with the guidelines of this document. All system construction and programming will be the responsibility of the control system integrator. All materials and labor shall be provided for a fully functional system including any items which are required for system operation but are not specifically addressed in this document or on the contract drawings.
3. This specification is intended to be used in conjunction with all drawings supplied and is not intended to be complete without reference diagrams on system configurations, etc. All bidders must conform to all areas of the documentation. It is the intent of this specification that the monitoring and control system contractor have single source responsibility for the complete control and instrumentation package for the project; including but not limited to flow, pressure, level instrumentation and control, Variable Frequency Drives, Solid State Soft Starters, generator, ATS and interconnecting conduit and control wiring for total system responsibility.
4. The instrumentation and control systems contractor will provide all local programming required for a fully functional pump control system and HMI operating panel.

B. General

1. As specified in the design plans, the system may or may not include one

or more pH monitoring/control system to continuously monitor pond pH and may have the option to automatically shut-down the alum system if the water pH drops below a set value.

2. It is the intent of these Specifications that the all the parts and components required for a complete and operable alum treatment system are furnished by applicable manufacturer(s) with overall coordination provided by the Instrumentation Specialist. The Contractor shall be responsible for procurement, installation success, and comprehensive of management of the alum treatment system.
3. The alum feed system(s) shall be capable of operating in a completely automatic mode.
4. The Contractor shall ensure that the manufacturer(s) works in conjunction with the Instrumentation Specialist to assure proper interface on proportional control based on 4-20 ma DC signal or other method, as shown on the design plans.
5. The systems shall include, but are not limited to, the following:
 - a. Alum pump and control system
 - b. Sensing devices
 - c. Shutoff and control valves
 - d. Alum carrier pumping system (as applicable to design)
 - e. pH monitoring/control system (as applicable to design)
6. All components that are subjected to corrosion shall be constructed of chemical and corrosion resistant materials and/or epoxy coatings.
7. The systems shall comply with all applicable OSHA and NEC rules and regulations.

C. General Design

1. The pump station electrical control equipment shall be wall mounted. See drawing for arrangement details.
2. The pump supplied shall have the following functions:

The alum pump shall be paced off the signal received from the control panel

or by local potentiometer control.

3. Operations:

- a. The discharge of the alum pump shall be tied into the line for delivering carrier water to the point of application.
- b. The pump motor shall be equipped with a motor over-temp alarm switch with indication on the control panel.
- c. The suction line feeding the alum pump shall be equipped with a sensor to automatically shut down the alum pump if the suction line is not full of liquid.
- d. The pump control system shall be equipped with a pH monitoring/control system to automatically shut-down the alum pump if the pond water pH drops below a predetermined and adjustable value.

1.2 CONTRACTOR QUALIFICATIONS AND ADDITIONAL RESPONSIBILITY

- A. The equipment shall be products of manufacturer(s) who are fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The system(s) components shall be designed, constructed, delivered, and installed in accordance with the best practices and methods.
- B. The system(s) shall be furnished by a single supplier, referred to as the Instrumentation Specialist, who shall coordinate the system installation for the proper operation of each system. The alum feed system(s) shall be supplied and assembled by Technical Solutions Inc., 117 Morningside Drive, Lakeland, FL, 33803, (863) 683-5371; or approved equal. Approved equal shall have demonstrated experience with a minimum of 10 previous projects, each of which include stormwater flow sensing, alum pumping systems for stormwater treatment, and related instrumentation. Experience with potable or wastewater systems will not be considered equivalent. The EOR shall have sole determination on the acceptability of the approved equal.
- C. The panel supplier shall be a UL listed panel shop and all panels shall be UL-508 certified. All panels shall utilize components in order to achieve a minimum of 10KA Short Circuit Current Rating (SCCR).
- D. The contractor shall assume total systems responsibility for all aspects of this system including installation, commissioning and start-up of the system, training of operating personnel and coordinating interfaces between this system and equipment provided by others. This responsibility shall include mounting and wiring of relays, transformers, disconnecting means, and other control devices

as required forming a complete system.

- E. All conduits are provided and installed under Division 26, BASIC ELECTRICAL MATERIAL AND METHODS. With the exception of certain specified special control, fiber optic and high-speed communication cables, all wiring and cables are provided and installed under Division 26, BASIC ELECTRICAL MATERIAL AND METHODS. Specific control cables and high-speed communication shall be provided and installed by the contractor.
- F. Where the term "verify" and "certify" are stated in this specification, the intent is that the control system integrator shall issue formal statements in writing to the engineer that the particular activity has been accomplished.

1.3 SUBMITTALS

A. SHOP DRAWINGS shall include:

1. A cover sheet consisting of a Bill of Material, purchase order number, manufacturer's job number, Owner's name, location, application and shipping address.
2. Mechanical layouts detailing the overall external dimensions of all enclosures. Include all pertinent information such as location of door handles, windows, lifting lugs and enclosure mounted items such as pump controller chassis and I/O modules (show cable connections on modules), relays, cooling fans, etc.
3. Details for mounting of the processor, I/O racks, relays, motor starters, disconnect switch, fuse blocks, wireways, etc. All materials shall be labeled to provide easy cross-reference to the Bill of Material listing.
4. Electrical drawings detailing all hardwiring, done by the supplier, to devices such as relays, pump controller modules, disconnect switches, fuse blocks, etc. Provide individual wire numbers and relay contact cross-reference designations.
5. A description of all input and output modules by name, rack, module and terminal location.
6. Complete master wiring diagrams, elementary schematics and control schematics shall be submitted for approval before proceeding with manufacture. Suitable outline drawings shall be furnished as part of this submittal. Standard or typical pre-printed sheets or drawings simply marked to indicate applicability to this contract will not be acceptable. Shop drawings shall be on standard 24" X 36" or 11" X 17" media; drawn with a computer aided design package. The computer aided design package shall be AUTOCAD version 2022 or converted to AutoCAD version 2022.

Engineering plan backgrounds of the facility shown on the contract documents will be available to the contractor on request. Submittals shall include reproducible plots of the drawings on paper translucent bond.

7. A complete drawing indicating each point of interface with the process control system and the type of signal provided or accepted at each point. This drawing shall depict the actual interface terminal block including all circuit designations.
8. A complete sequence of operation describing the control strategy in response to external signals and the signals which will be provided to the process control system during operation of the plant. All interlocks and limits which are internal to the operation of the controls shall be included in this description.
9. A drawing showing the layout of the control panels indicating every device with complete identification.
10. Analog and digital loop diagrams showing all I/O from the point of origin in the field device through the wiring systems to the RTU controller and HMI systems. Include all terminal block points and identification, color codes, tag names and numbers, etc. Include device range and calibration data for the analog device loop diagrams.
11. The last sheet(s) in the set shall describe all terminal block designations and individual terminal numbers.
12. Descriptive literature, bulletins, and/or catalogs of each item of equipment.
13. Complete motor data.
14. Data on the characteristics and performance of all pumps.
15. Manufacturers' installation requirements.
16. Narrative description of controls.

B. RECORD DRAWINGS

1. Record Drawings shall accurately show the installed condition of the following items:
 - a. Underground raceway and duct bank routing.
 - b. Field locate all in ground or above ground pullboxes.
 - c. Field locate all in ground or above ground splice boxes.

2. Legibly record all existing conditions to scale on a set of Project Contract Drawings, (the "Record Drawings") or hand sketched drawings.

C. Additional Information

1. In the event that it is impossible to conform with certain details of the Specifications, describe completely all non-conforming aspects.
2. Provide equipment warranty.

D. Operating Instructions

The Contractor shall develop a detailed set of operational and maintenance instructions for all alum addition system components, including controls, chemical feed pump, carrier water pump, and automated valves.

1. Two (2) copies and one (1) digital copy (PDF format) of operating and maintenance instructions shall be furnished to the Owner's Representative. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.
2. A factory representative or approved equal, who has a complete knowledge of the proper operating and maintenance, shall be provided to instruct representatives of the Owner and the Owner's Representative on proper operation and maintenance of the equipment. This work may be conducted in conjunction with the inspection of installation and test run as provided under sub-section 3. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service to correct the condition shall be provided at no cost to the Owner.

1.4 WARRANTY

- A. All materials and workmanship outlined in this Provision shall have a 1-year warranty, beginning at formal written acceptance of the Work by the EOR, and will include all parts, labor, and return shipping (if necessary). All warranties shall list the Owner as the warranty holder.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Specifications are intended to give a general description of what is required,

but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation, and field testing of all materials, equipment, and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these Specifications, or shown on the Design Plans shall be furnished and installed.

- B. The material covered by these Specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Design Plans.
- C. All equipment shall be designed and proportioned to have liberal strength, stability, and stiffness and to be specially adapted for the intended service.
- D. All equipment and piping shall be rigidly and accurately anchored into position and all necessary foundation bolts, plates, nuts, and washers shall be furnished and installed. All bolts, nuts, and washers shall be of stainless steel unless otherwise specified by the EOR.
- E. All electrical materials and equipment shall be Underwriters Laboratories, Inc. listed.
- F. All motors included under this Section shall conform to NEMA Standards, with Class B insulation and temperature rise and designed for operation in a 40°C ambient environment. Motors 1 hp and larger shall have a 1.15 service factor. The service factor shall not be used when the equipment is operating under any normal operating condition. Motor horsepower and speed shall be as determined by the system supplier and approved by the Owner's Representative.
- G. Removable, all metal guards in complete conformance with OSHA shall be provided for all motor couplings, V-belt drives and similar exposed rotating elements.
- H. Each system, when completed, shall be completely dust tight. Equipment installed outdoors shall be weathertight, suitable for outdoor operation.
- I. All bolts, nuts, washers, clamps, etc., used to interconnect system components shall be manufacturers standard for this service.
- J. Electrical connections to each item of equipment subject to vibration shall be made with flexible liquid tight plastic conduit.
- K. The software written for this application shall be in ladder logic and provide a

flexible, configurable and expandable control system for the pump station. The vendor shall provide a licensed copy of all software used in this project and registered to Lee County. All ladder code provided with this contract shall be documented so that an experienced programmer can easily make modifications to the software without having to go back to the original vendor for information. Documentation shall be approved by the engineer before final acceptance of the software. Lee County Utilities shall be the owner of the ladder logic program integration and shall have its unlimited use. LEE county shall provide the Ladder Logic programming for use with the pump stations.

- L. Components: All motor branch circuit breakers; motor starters and control relays shall be of highest industrial quality, securely fastened to the removable back panels with screws and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component. A circuit breaker or externally mounted disconnect shall be provided for each control panel as a means of disconnecting power to the control panel.
- M. All internal control panel wiring shall be identified at both ends with type written heat shrinkable wire markers with the numbering system shown on the control submittal drawings.
 - 1. Control wiring shall be stranded copper, minimum size #1 AWG (except for shielded instrumentation cable may be #18 AWG), with 600 volt, 90 degree C, flame retardant, Type MTW thermoplastic insulation. Each control wiring conductor shall have heat shrink identification labels on each end of termination. Terminations shall be made to screw terminal strips. All points of terminal strips are to be labeled to match conductor labeling.
- N. The control panel shall be provided with nameplates identifying each component, selector switches, pilot lights, etc. Nameplates shall be permanently affixed using an epoxy process. Nameplates shall be laminated plastic, engraved white letters with a black background.
- O. Corrosion Inhibitor Emitter: Provide an industrial corrosion inhibitor emitter, on all exterior mounted control panels that will protect internal components of the control panel from corrosion. Provide 1 year supply of spare corrosion inhibitors for each control panel.
- P. Fused terminal blocks shall be provided for analog inputs and outputs. Blocks shall be permanently marked to indicate the appropriate I/O address of each circuit on the pump controller. Terminal strips shall be switch type with integral fuses equal to Allen Bradley 1492-H6. Wiring from the control panel to the terminal strips shall be factory installed. All spare conductors shall be terminated and identified.
- Q. The assembled system shall include circuit breakers, fuse blocks and other electrical components as required by the application and in accordance with the

standard requirements of the National Electric Code as well as all State and Local electrical code requirements.

- R. All I/O racks, processor racks and power supplies shall be grounded in accordance with the manufacturer's specifications.
- S. All push-buttons, switches and other operator devices shall be UL listed and/or CSA approved and sufficiently large and durable to provide dependable, long life operation. Provide 30mm devices.
- T. All cables, plugs, connectors and receptacles requiring user field installation shall be designed to withstand an industrial environment.
- U. Surge suppressors shall be provided for all analog inputs and outputs and digital inputs that leave or enter the RTU and local control cabinets.

V. RELAYS

1. Control circuit switching shall be accomplished with relays. These relays, for interfacing and control applications, shall be the compact general purpose plug-in type having low coil inrush and holding current characteristics. An LED status-indicating light shall be provided with each relay. Contact arrangements shall be as noted or shown, and shall be rated for not less than 10 amperes at 120V ac or 28VDC. Coil voltage shall be as noted or shown. Non-latching relays shall have a single coil. Latching relays are not acceptable. Relays shall have plain plastic dust covers, test buttons, and mounting sockets with screw terminals and hold-down springs. Relays shall be UL recognized. Relays shall be Square D or Allen Bradley, Omron or approved equal.
2. All relays shall have a screw terminal interface with the wiring. Terminals shall have a permanent, legible identification. Relays shall be mounted such that the terminal identifications are clearly visible and the terminals are readily accessible.

2.2 MATERIALS AND EQUIPMENT

- A. Alum feed system components to be factory assembled, with the control panel shipped separately.
- B. Alum Metering:
 1. The feed pump shall be a diaphragm metering pump with adjustment to attain the minimum and maximum capacities required. The specific make and model of the alum pump, as correlated to the maximum and minimum stormwater treatment flow rates, shall be provided on the design plans

- a. Minimum alum addition rate = 0.3 gph
 - b. Maximum alum addition rate = 34.7 gph
2. The alum feed pump shall be of suitable materials for pumping the respective chemical solutions. The pump shall be a diaphragm metering pump.
 3. Pump flow span shall be adjustable over a 0.5% to 100% range in 0.1% increments based on a 4-20 mA input.
 4. The chemical feed pump shall have the following specifications:
 - a. Maximum working pressure: 80 psig
 - b. Maximum fluid temperature: 130°F
 - c. Maximum fluid viscosity: 1,000 centipoise
 - d. Maximum suction lift: 15 ft water
 - e. Motor: Brushed DC
 - f. Voltage: 115 VAC/60 Hz, 1 ph
 - g. Duty cycle: Continuous
 - h. Display: Backlit LCD, UV resistant
 - i. Keypad: Positive action tactile switch keypad
 - j. Enclosure: NEMA 4X and 1P66 rated
 - k. External communications: Flow verification system; 4-20 mA; 0-10 VDC pulsed
 - l. Wetted components
 - (1) Diaphragm: Teflon (Teflon-coated Hypalon)
 - (2) Pump head and adapters: PVDF (natural)
 - (3) Injection/check valve
 - (a) Body and insert: PVDF (natural)
 - (b) Check ball: Ceramic
 - (c) Spring: Hastelloy C-276
 - (d) Elastomers (O-ring): Viton (optional EP)
 - (4) Footvalve/strainer: PVDF/polypropylene (natural)
 - (5) Suction tubing: PVC (clear)
 5. Pump head, injection/back-flow check valve, and foot valve strainer materials shall be compatible with continued exposure to alum.

6. The feed pump shall be a Chem-Pro C-3 Series diaphragm metering pump (Model C3V242XVA) or approved equal.
- C. Backpressure and Pressure Relief Valves
1. The valves shall be designed to operate with the chemical solutions being pumped.
 2. The valve diaphragm shall be made of an elastomer (Hypalon) bonded to a TFE facing.
 3. The valve shall operate in the following manner: Line pressure on the diaphragm is opposed by spring compression. When line pressure reaches the valve set in the spring, the diaphragm moves off its seat to dissipate the excess pressure by permitting flow. Pressure range shall be 0-100 psi.
- D. pH Monitoring / Control System: These specifications are documented within Section 43 09 00.
- E. System Control Panels: These specifications are documented within Division 26.
- F. Air Injection Venturi
1. The venturi shall be constructed of fiberglass, plastic, stainless steel, or other material compatible with continued exposure to alum.
 2. Venturi shall be a classical flanged venturi, 3-inch x 1½-inch with 1-inch threaded connection in low-pressure area.
 3. Venturi to be provided by Imperial Flange and Fitting Company, Los Angeles, CA, or approved equal.
- G. Control panel enclosures shall include the following features:
1. Internal Light with toggle-Switch
 2. Internal Service Power Outlets
 3. Drawing Pockets in the back side of the door
 4. Laptop Ethernet Connection

2.3 TOOLS AND SPARE PARTS

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- A. All special tools required for normal operation and maintenance of the equipment shall be furnished with the equipment by the manufacturer.
- B. Spare Parts: Provide two complete sets of spare parts for the chemical feed pump. Additional spare parts shall be furnished to assure normal running and maintenance for a period of one year as recommended by the manufacturer of equipment under this Section.
- C. All tools and spare parts shall be furnished in containers clearly identified with indelible markings as to their contents. Each container shall be placed with its contents protected for storage. All tools shall be furnished in steel tool boxes.
- D. Provide one liter of pH solutions 4.0 and 7.0 to calibrate the pH controller and one spare pH sensor.

PART 3 - EXECUTION

3.1 INSTALLATION

Installation shall be in strict accordance with the manufacturer's instructions and recommendations, in the location shown on the Design plans. Installation shall include furnishing the required lubricants for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

- A. The work included in this section consists of furnishing, installing and placing in operation the instruments and appurtenances, including all conduit, wiring and circuitry, necessary to provide the Owner with a fully operable system properly calibrated and installed.
- B. All workmanship utilized in the manufacture and installation of this system shall be of the highest quality and performed in a manner which is consistent with all accepted practices for industrial controls.
- C. Provide continuous protection of the installed instrumentation equipment from the elements, moisture, construction damage, dust, debris, paint spatter or other conditions which will adversely affect the unit operation until such time as the equipment is scheduled for start-up testing.

3.2 MOUNTING OF EQUIPMENT AND ACCESSORIES

- A. Install and mount equipment in accordance with the Contract Documents, manufacturer's instructions and installation detailed shop drawings. Mount equipment so that they are rigidly supported, level and plumb, and in such a manner as to provide accessibility; protection from damage; isolation from heat, shock and vibration; and freedom from interference with other equipment,

pipng, and electrical work. Do not install field enclosures, cabinets, and panels until heavy construction work adjacent to the equipment has been completed to the extent that there shall be no damage to the equipment.

- B. Locate devices, including accessories, where they shall be accessible from grade, except as shown otherwise.
- C. Coordinate the installation of the electrical service to components related to the system to assure a compatible and functionally correct system. All accessories shall be coordinated and installation supervised by the Contractor.

3.3 INSPECTION AND TESTING

- A. Contractor is responsible for assuring services, labor and equipment of a manufacturer as specified herein. The equipment manufacturer shall furnish the services of a competent and experienced representative who has complete knowledge of proper operation and maintenance of the equipment to inspect the installed equipment, supervise the initial test run, and to provide instructions to the designated operational personnel. The first visit will be for checking and inspecting the equipment after it is installed. The second visit will be to operate and supervise the initial field test and to instruct the plant personnel in the operation and maintenance of the equipment. The final copies of operation and maintenance manuals must have been delivered to the Owner's Representative prior to scheduling the instruction period with the Owner.
- B. Upon completion of installation, the manufacturer, in the presence of the Owner's Representative, shall perform a preliminary test over the full range of each system to ensure the functioning of all component parts to the satisfaction of the Owner's Representative. The test shall be over the full range of capacity. The manufacturer shall furnish all labor and equipment. Water and power shall be supplied by the Contractor. Approval of the preliminary test by the Owner's Representative shall not constitute final acceptance of the equipment furnished.
- C. After the project is in operation, a full operating test shall be performed in the presence of the Owner's Representative and a qualified manufacturer's representative on the system. The manufacturer shall furnish all labor, materials and equipment required for such tests and shall correct any deficiencies noted by repairing or replacing the defective component and retesting as required until the equipment meets the specifications and the satisfaction of the Owner's Representative. A performance check shall be made on each metering pump with alum. Pumps shall be tested at 10 percent, 20 percent, 50 percent, 75 percent and 100 percent of scale, as required. The total error based on the field determined instrument errors, shall not exceed plus or minus two percent of the actual flow for the pumps. If, during running of the tests, one or more points appear to be out by more than the specified amount, the manufacturer's field engineer shall make such adjustments or alternations as are necessary to bring equipment up to specification performance. Following such adjustment, the tests

shall be repeated for all specified points to ensure compliance. Thirty days will be allowed for any changes necessary to meet the specifications. Otherwise, the Owner reserves the right to have the rejected equipment removed from the site and replaced at CONTRACTOR's expense by satisfactory equipment that operates in accordance with the specifications. Alum for the full operating test will be furnished by the Owner.

3.4 INITIAL FIELD TESTING

- A. All system start-up and test activities shall follow detailed test procedures, test report, check lists, etc., submitted and previously approved by the Engineer.
- B. Verify that each instrument, meter, and gage has been properly installed, connected, grounded and calibrated. Perform three-point calibration on continuous elements and systems. Provide calibration records.
- C. Verify that the input/output functions of each instrument conform to the requirements of the application.
- D. Exercise each system as defined by each loop description through operational tests to demonstrate that it performs as intended on a continuing basis and to demonstrate the integrity of the system.
- E. Each loop tested shall be witnessed, dated and signed off by both the Contractor and the Engineer/owner upon satisfactory completion.

3.5 INITIAL START-UP TESTING

- A. Perform satisfactory Contractor's initial start-up and functional test prior to demonstration for Owner and Engineer.
- B. After the field testing has been successfully demonstrated, a date for system start up involving the Owner's operating personnel will be scheduled as agreed to by the Owner. Notify Engineer fourteen (14) days prior to initial start-up of each item of equipment.
- C. Have Contract Documents, shop drawings, product data, and operation and maintenance data at hand during entire start-up process.
- D. Provide control diagrams that show actual control components and wiring.
- E. Coordinate sequence for initial start-up of various items of equipment
- F. Verify control systems are fully operational in automatic and alternate modes of operation.

- G. Start up and test the instrumentation equipment with the entire system operational. Conduct start-up and initial functional testing.

3.6 STARTUP AND FUNCTIONAL TESTING, DEMONSTRATION FOR OWNER AND ENGINEER

- A. Perform pre-startup inspection of installation. Perform startup under no-load conditions, if possible. Observe noise, vibration and operation. If all operating characteristics are normal, proceed with startup. Operate equipment and systems under all load conditions and confirm all operating characteristics are normal. If normal operation is observed, proceed with witnessed functional test and performance test as required.
- B. Perform functional and performance tests under supervision of responsible manufacturer's representatives, control system integrator, and Contractor personnel. Representatives of Owner and Engineer shall witness functional test. Perform functional and performance tests on each piece of equipment and operational system as specified in the individual product sections.
- C. Demonstrate that equipment operates and complies with specified performance requirements. Demonstrate that control panel functions, including failures and alarms operate and comply with specified performance requirements.
- D. Functionally test failures and alarm conditions; or if approved by engineer simulate by jumping failure input terminals. Provide signal generators that simulate control conditions if it is not feasible to create actual conditions. Testing activities shall include the simulation of both normal and abnormal operating conditions.
- E. Use Operation and Maintenance manuals, loop descriptions, submittals, graphic screens, etc., to demonstrate operation of equipment. Use actual as-built control diagrams in demonstration of functions.
- F. Each control strategy shall be tested by the Engineer to verify the proper operation of all required functions. The control system start-up and test activities shall include procedures for tuning all control loops and for adjusting and testing all control loops as required to verify specified performance.

END OF SECTION

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SECTION 43 02 00

FIBERGLASS-REINFORCED PLASTIC TANKS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Scope of Work
- B. Description
- C. Quality Assurance
- D. Submittals for Drawings and Data
- E. Product Delivery, Storage and Handling
- F. Warranty and Guarantees

1.2 SCOPE OF WORK

The CONTRACTOR shall furnish and install a fiberglass reinforced plastic (FRP) tank(s) for the storage of liquid alum, $\text{Al}_2(\text{SO}_4)_3 \cdot 14 \text{H}_2\text{O}$ (48.5%).

1.3 DESCRIPTION

- A. The tank furnished and installed under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, recommendations of the fabricator, and installed in accordance with local/state regulatory requirements – unless exceptions are noted by the EOR.
- B. The CONTRACTOR shall coordinate the work between the suppliers of equipment to be used with or connected to the storage tanks to ensure that all required provisions for mounting the accessories are included.
- C. This work includes all materials and labor for fastening the tank to the anchor slab in accordance with the manufacturer's recommendations.

1.4 QUALITY ASSURANCE

Governing Standards: Except as modified or supplemented herein, all materials

and construction methods shall comply with the applicable provisions of the following standard: ASTM Standard D03299 and ASTM RTP-1.

1.5 SUBMITTALS FOR DRAWINGS AND DATA

- A. Complete drawings, details, and specifications covering the storage tanks and accessories shall be submitted.
- B. The data shall include full information on basic materials and test data confirming the chemical resistance of the proposed resins to the intended tank contents.
- C. The data shall also indicate the sizes of all major tank components including tank diameter, tank height including support legs, wall thickness, nozzle details and locations, anchor bolt locations and details, and full information and details concerning field assembly and installation.
- D. Manufacturer's certificate of testing for primary and secondary tank.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

The tanks and components shall be adequately protected during transportation, in storage at the job site, and during subsequent installation and construction activities. Damaged units will be rejected and shall be replaced with undamaged units.

1.7 WARRANTY AND GUARANTEES

The tank will not fail for a period of ten (10) years due to corrosion or structural failure. If failure occurs, replacement tank to be provided at vendor's expense.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

The tanks shall be as manufactured by:

- A. Augusta Fiberglass
- B. Belding Tank Technologies, Inc.
- C. Edwards Fiberglass, Inc.
- D. Southeast Fiberglass Products, Inc.

E. Tank Connection

F. XERXES Corporation

2.2 MATERIALS

Tanks shall be manufactured with 100% resin and glass fiber reinforcement. No sand filler. Basic materials shall be as follows:

- A. Resin: Bisphenol-A polyester or vinyl ester resins suitable for use with the specified chemicals.
- B. Reinforcement: Glass fiber with a suitable coupling agent.
- C. Surfacing Material: Surlington Formed Fabrics "Nexus Veil", Nicofibers "Surmat 100", or equal.
- D. Plastic Laminate: Conformity with the applicable governing standards.
- E. Exposed Assembly and Bolts, Nuts, and Washers: Type 316 stainless steel.

2.3 PERFORMANCE AND DESIGN REQUIREMENTS

A. CONDITIONS OF SERVICE: Each tank will normally be used to store the specified chemical at atmospheric pressure. The tanks shall be designed for the storage of the following liquid chemicals:

1. Chemical:	Alum
2. Location:	As shown
3. Maximum Concentration by Weight (%):	50
4. Maximum Specific Gravity:	1.4
5. Maximum Temperature (°F):	120
6. Minimum Temperature Tank Contents (°F):	----

B. Design Criteria

- 1. Each tank shall be designed to withstand the hydrostatic head plus 24 inches water column.
- 2. The location, capacity, and dimensions of the tank(s) are specified within the design plan sheet set.

3. Each tank shall consist of one of the following configurations, as specified within the design plan sheet set.
 - a. Above-ground location, single wall tank installed within full containment structure.
 - b. Above-ground location, double-wall tank installed without containment structure.
 - c. Below-ground location, double-wall tank installed without containment structure.
4. The above-ground horizontal tank to be provided with FRP hollow support saddles which are attached to the tank shell. Height of the saddles to conform to dimensions and under-tank clearances indicated on the Construction Drawings. The support saddles shall be filled with concrete per manufacturer's instructions.
5. The tank shall be designed in accordance with the applicable design standards referenced herein. Design calculations shall be provided for each tank and shall be signed and sealed by a professional engineer, preferably registered in the State of Florida.

2.4 FABRICATION AND MANUFACTURER

- A. The tanks shall be hand lay-up, spray-up, or filament wound construction in accordance with the applicable governing standard. All tank shells and dishes shall be shop fabricated in a controlled environment by the manufacturer and no vertical seams shall be allowed. The finished laminate shall be constructed using a single generic type of thermoset resin throughout and shall not contain colorants, dyes, fillers, or pigments unless otherwise specified. Ultraviolet absorber shall be added to the resin used in the fabrication of tanks indicated on the drawings or specified to be suitable for installation in exposed, exterior locations.
- B. The top of each tank shall be reinforced in accordance with the requirements of the applicable governing standard. Additional reinforcement shall be provided as necessary to support the required accessories. As applicable to the project, vertical tanks shall have the surface of each domed top provided with a non-slip finish.
- C. Bracketed flat surfaces shall be provided on each tank for the installation of a liquid level gauge, a nameplate, and a certification plate.

- D. Minimum of three lifting lugs shall be provided on each tank as required for handling and installation.
- E. The finished tank shall be hydrostatically tested for a duration of one hour. Any leaks detected during the testing shall be repaired by the manufacturer and the tank retested until no detectable leakage is observed. A certification of successful testing shall be provided to the OWNER.

2.5 ACCESSORIES

Accessories shall be provided on each tank as indicated on the drawings and as specified herein.

- A. Access Manholes: Access manholes shall have an inside diameter of 22 inches and shall be provided on the tank as indicated on the drawings. Each manhole shall be flanged, fully gasketed, and furnished with a fabricated blind flange having the same properties as the tank wall laminate. Gasket materials shall be compatible with and fully resistant to the chemicals stored. Flange diameter and drilling shall conform to ANSI B16.5, Class 150.
- B. Flanged Nozzles:
 - 1. Nozzles for connecting piping and accessories shall be provided on each tank at the locations and of the sizes indicated on the drawings or specified herein.
 - 2. Each nozzle shall be flanged, with flange diameter and drilling conforming to ANSI B16.5, Class 150. Nozzles shall extend at least 3 inches from outside face of tank to face of flange unless otherwise noted on the plans.
 - 3. Flanged nozzles shall be fabricated of the same material as the tank and shall be gusseted to the tank or otherwise reinforced in accordance with governing standard.

4. Each tank shall be provided with flanged nozzles as specified on the design plans. At a minimum, each tank shall contain the following:

QUANTITY	CONNECTION	NOZZLE SIZE (inches)	LOCATION ON TANK
1	Vent	3	Top
1	Fill	2	Top
1	Discharge	2	Bottom
1	Upper Sight Tube Port	1	Near Top
1	Lower Sight Tube Port	1	Near Bottom
1	Access Manway	22	Horizontal Tank – end
1	Leak Detection	1	Bottom – per manufacturer
1	Interstitial Vent	1	Top

5. Tank shall also have a sight tube with laminated strip chart calibrated in gallons.
6. If level monitoring equipment is specified, include a 12", 150 lb. flanged nozzle with a minimum height of 12" above tank outside diameter to accommodate a flanged ultrasonic transducer. Locate nozzle at the opposite end of tank from the fill nozzle.
- C. Vents: Each tank shall be provided with a vent of the size recommended by the manufacturer to prevent developing pressure or a vacuum inside the tank during filling, pumping, or draining. The vent shall also be equipped with an insect screen of material compatible with the chemical stored.
- D. Certification Plates: A stainless steel certification plate shall be installed on the body of the tank. The following data shall be included on the certification plate:
1. Name of tank fabricator
 2. Date of manufacture
 3. Product to be stored
 4. Maximum allowable concentration, specific gravity and temperature of the specified chemical solution that can be stored safely

5. Mechanical properties of the laminate
 6. Resin designation
 7. Maximum fill volume
- E. Flexible Connector: The discharge piping from the tank bottom will include a flexible bellows-type connector to accommodate tank expansion during filling. All portions of the connector in contact with alum must be constructed of plastic, rubber, or other non-metal corrosion-resistant material. Connections shall be flanged.
- F. Basket Strainer: A basket strainer will be installed in the discharge piping from the tank to remove solids prior to reaching the alum feed pump. Basic requirements are as follows:
1. Material: Both screening and housing shall be PVC
 2. Maximum Operating Pressure: 150 psi
 3. Intake and Discharge Size: 2 inches
 4. Screen Mesh: 1/8 inch
 5. Mounting: Floor Mounting
 6. Manufacturer: Hayward

PART 3 – EXECUTION

3.1 INSTALLATION

- A. The tanks shall be installed at locations as indicated on the drawings. The tanks shall be installed in accordance with the fabricator's recommendations, the requirements of the applicable governing standard, and to the satisfaction of the EOR, and made ready for the installation of piping and other appurtenances as indicated on the drawings and specified under other sections.
- B. Once the tank is installed, the tank will be filled with water for 30 days prior to making any piping connections to detect leaks.

3.2 FIELD QUALITY CONTROL

After completion of installation, the tanks shall be filled with water to the top access manhole opening and allowed to stand full for a period of not less than 48 hours. During testing, flanged connections may be plugged by the installation of

temporary blind flanges on the outside of the tank but shall not be blocked or plugged on the inside. All leaks or indications of leaks shall be repaired by the fabricator and made completely watertight. A leaking tank, upon repair, shall be retested to the satisfaction of the EOR.

3.3 CLEANING

When installation has been completed and all connections have been made, all tank surfaces, interior and exterior, shall be thoroughly cleaned as recommended by the fabricator and to the satisfaction of the EOR. Abrasive cleaning agents shall not be used. The tank and wetted accessories shall be completely dried before being placed into service.

END OF SECTION

SECTION 43 03 00
ALUM INJECTION STRUCTURES

PART 1 – GENERAL

1.1 SCOPE OF WORK

Provide and install the pond injection structures as indicated on the Construction Drawings.

1.2 DESCRIPTION

The CONTRACTOR will fabricate and install the pond injection structure as indicated on the Construction Drawings. Alternate designs must be accompanied by Shop Drawings and engineering calculations, signed and sealed by an engineer registered in the State of Florida. The injection structure must be securely attached to the specified concrete pad with legs to extend the injection system above the lake bottom.

1.3 MATERIALS

A. Eductor Manifold

1. The eductor manifold shall be constructed of 316 SS, polypropylene, HDPE, or other material approved by EOR. All joint connections shall be flanged and PVC is not acceptable. Fittings for eductor nozzles shall be 2-inch NPT male.

B. Eductor Nozzles

1. Eductor nozzles shall be constructed of 316 SS PPL (glass-reinforced polypropylene) or PVDF (KYNAR). Nozzle sizes are indicated on the Construction Drawings.
2. Eductors shall be provided by Northeast Controls, Inc.
(Phone: (201) 419-6111) or approved equal.

C. Flexible Connector Hose: A flexible connector is used to connect the eductor manifold to the distribution piping.

1. Hose Length: 5 ft
2. Hose Diameter: 6 inches

3. End Fittings: 1 male + 1 female PP camlock fitting
4. Hose Material: heavy-duty flexible PVC material or approved equal; must be ozone and UV-resistant

1.4 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be submitted to the EOR for approval. Shop drawings shall include dimensional layouts, materials, details of appurtenances, anchoring, installation, and operation instructions. Fabrication and installation shall be in accordance with such approved drawings.
2. A digital copy (PDF) of the manufacturer's operation, installation, and maintenance manual shall be submitted for approval prior to shipment of the equipment.

B. Alternate Equipment:

1. If the CONTRACTOR desires to offer equipment as an alternate to the specified equipment, he shall submit (within 14 days after the bid opening) substantial descriptive information in order that the EOR may determine if the proposed alternate is equal or superior quality to that specified.
 - a. No alternate will be considered unless, in the opinion of the EOR and OWNER, it conforms to the specification in all respects except manufacturer, model, and minor details. Material variances will not be allowed.
 - b. Alternate equipment which is a "standard product" of the manufacturer shall be modified, re-designed, or furnished with special features or special materials as may be necessary to conform to the requirements of this specification and contract drawings.
 - c. The OWNER reserves the right to decide whether or not the proposed alternate will be acceptable.
2. The Contract, if awarded, will be on the basis of material and equipment specified without consideration of alternate equipment. In the event an alternate is allowed, the Contract price will be adjusted accordingly by a Change Order.
 - a. By submitting a bid, the CONTRACTOR agrees and understands that Contract award will be made on the basis of the specified equipment.

- b. If an alternate is found to be not acceptable, the CONTRACTOR shall be responsible for supplying the equipment specified.

PART 2 – WARRANTY

All materials and workmanship outlined in this Section shall be warranted for a period of one (1) year or the extent of the manufacturer's warranty, whichever is greater, from the date of final acceptance by the OWNER. The warranty shall include all materials, labor, and shipping (if necessary).

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 43 04 00

DOUBLE-WALL CONTAINMENT PIPING

PART 1 – GENERAL

1.1 SCOPE OF WORK

The Contractor shall furnish and install double-wall containment piping as indicated on the construction plans.

1.2 MATERIALS

- A. The pipe and fittings shall be of the same material for both the inner and outer piping. The responsible designer shall exercise good engineering practice in all areas including the selection of the materials of construction.
- B. Black UV stabilized block co-polymer polypropylene shall meet the requirements of ASTM D4101. Material shall provide weathering resistance for outdoor use without further coating, covering or wrapping.
- C. High-density polyethylene shall meet the requirements of ASTM D3408 cell classification 345434C or 355434C. All related accessories shall be made from the same resin.
- D. Elastomers shall be selected by the designer with regard to the compatibility of the fluid service anticipated. O-rings must be inspected during installation to verify surface quality, and as with all sealing materials, periodic inspections may be appropriate. Stainless steel bolts, nuts and washers are recommended for flange assemblies.

1.3 CONFIGURATION

- A. All pipe shall be one-piece double-wall extruded simultaneously. The primary pipe shall be integral with the secondary pipe via connecting ribs, which are continuous down the entire length of each section of pipe. No centralizing clips, spiders, disks or supports shall be allowed.
- B. Molded double containment fittings shall be of unitary construction. Permanent alignment of the inner and outer fittings shall be maintained via molded-in ribs. The ends of both the inner and outer fittings shall be flush (in one plane). Molded-in supports shall be set back from the ends of the fittings to allow mixing of any fluids in the annular space.
- C. Fabricated fittings in Polyethylene and Polypropylene shall be allowed

provided all welds are butt fusion style. The manufacturer shall provide pressure ratings on fabricated fittings.

- D. Identical wall thickness for the inner and outer walls is mandatory for each size.
- E. Termination of the double containment shall be conducted utilizing a termination flange or Female, Metric socket or IPS spigot adapter.

1.4 PRESSURE RATING

- A. Pipe and fittings shall be rated for 100 psi in all sizes and materials at 73°F.
- B. Inner and outer fittings shall both be rated for 100 psi, including all termination fittings, transition fittings and drainage fittings.

1.5 JOINING METHODS

- A. All field welding shall be butt welded per the general guidelines of ASTM D2657 for polyolefin piping, and in general accordance with the manufacturer's printed guidelines.
- B. Mechanical connections in polypropylene can be conducted utilizing a double wall flange adapter. A double wall flange shall be connected to a double wall O-ring flange for proper sealing.

1.6 INSTALLATION AND SUPPORT

- A. Installation procedures shall be as per the manufacturer's written specifications. Pipe support spacing must be adequate to prevent any appearance of sagging. Standard design practice for single wall thermoplastic piping with regard to expansion and contraction shall be followed. Valves and other auxiliary items shall be independently supported.

1.7 SYSTEM TESTING

A. Pressure Systems

1. To fully test both the inner and outer containment for full pressure rating a hydrostatic test of both the inner and outer pipes shall be performed as outlined in the Uniform Plumbing Code Section 318 as directed by the local Administrative Authority. Specifically, a water pressure test at 1.5 times (150%) the normal working pressure of the inner pipe should be applied to both the inner and outer walls in separate tests.
2. To avoid a possible leak in the carrier from contaminating the containment space, a 5 to 10 psi air test can be first conducted for a quick check of the system.

3. To avoid moisture in the containment an air test can be conducted on the containment pipe. Pressure test is recommended at 5 psi and shall not exceed 10 psi. The inner carrier pipe shall be full of water and under pressure to avoid any possible collapse.
4. When testing with air on both the carrier and containment piping the ambient temperature should be above 32°F and extra safety precautions for personnel shall be put in place during the test

B. Drainage Systems

1. For systems in drainage applications, a hydrostatic test of 1.5x the working pressure is recommended for the carrier pipe. To avoid moisture in the containment an air test can be conducted on the containment pipe. Pressure test is recommended at 5 psi and shall not exceed 10 psi. The inner carrier pipe shall be full of water and under pressure to avoid any possible collapse. When testing with air the ambient temperature should be above 32°F and extra safety precautions for personnel shall be put in place during the test.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 43 06 00

HEAVY-DUTY STOP LOG ASSEMBLY

PART 1 - GENERAL

1.1 SCOPE OF WORK

The contractor shall furnish and install Heavy-Duty Stop Logs and guide(s) as manufactured by Plasti-Fab, Inc.; P. O. Box 100; Tualatin, OR 97062, or approved equal on the front surface of the intake structure, as indicated on the construction plans. Stop log(s) and guide(s) shall be furnished complete with necessary lifting devices and shall be fabricated, assembled, and placed in proper operating condition in accordance with installation instructions and recommendations of the equipment manufacturer. Equipment shall be the latest product design of a manufacturer regularly engaged in the production of equipment of this type.

Manufacturers other than the above-named company wishing to quote on equipment in this section shall submit detailed drawings of their proposed equipment and suitable evidence of experience and results to the engineer and obtain written approval to quote at least ten (10) days prior to bid opening.

1.2 DESIGN CRITERIA

A. WORKMANSHIP

Composition of the stop log laminate shall be in accordance with the recommendations shown in the Quality Assurance Report for Reinforced Thermoset Plastic (RTP) Corrosion Resistant Equipment prepared under the sponsorship of the Society of the Plastics Industry, Inc. (SPI). And the Material Technology Institute (MTI) of the Chemical Process Industry for "Hand Lay-up Laminates," and shall meet the specifications for Type I, Grade 10 laminates shown in Appendix M-1 of said report.

B. DESIGN

The stop log cover shall be fabricated so as to totally surround the internal structural matrix and protect it against corrosion from moisture or chemical deterioration. Stop logs shall be designed so that the maximum fiber stress (ultimate or yield, whichever applies) does not exceed 2.5 times the working stress. Stop logs shall be suitably reinforced to withstand the

maximum seating head with a deflection less than $l/360$ of the gate width, or 1/4 inch, whichever is less. Stop log covers that are fabricated from pressed or laminated sheet material and glued to a substructure shall not be acceptable.

All stop logs shall be flat and level. Warpage throughout the entire stop log shall not produce a crown of more than 1/16 inch in any direction. Visual inspection for defects shall be made without the aid of magnification. Defects shall be classified as to type and level as shown in Table I of ANSI/ASTM D2563-0, approved 1977, or any subsequent revision. Allowable surface tolerances shall not exceed the following:

DEFECT	ALLOWABLE TOLERANCES
Cracks, crazing, chips, pits, blisters, dry spots, fish eyes, burned areas, or entrapped air	None
Scratches	None more than 0.002 inches in depth
Exposed glass, exposure of cut edges	None
Wrinkles and solid blisters	Maximum deviation: 10% of thickness, but not to exceed 1/8 inch
Surface porosity (pinholes) or pores in the laminate surface	None
Foreign matter	None

- C. Leakage: Maximum allowable leakage of stop logs with seating head shall not exceed 0.20 GPM/ft of wetted perimeter.

1.3 SUBMITTALS

A. SHOP DRAWINGS

1. Shop drawings shall be submitted to the EOR for approval. Shop drawings shall include dimensional layouts, materials, details of appurtenances, anchoring, installation, and operation instructions. Fabrication and installation shall be in accordance with such approved drawings.

2. A digital copy (PDF) of the manufacturer's operation, installation, and maintenance manual shall be submitted for approval prior to shipment of the equipment.

B. ALTERNATE EQUIPMENT

1. If the Contractor desires to offer equipment as an alternate to the specified equipment, he shall submit (within 14 days after the bid opening) substantial descriptive information in order that the EOR may determine if the proposed alternate is equal or superior quality to that specified.
 - a. No alternate will be considered unless, in the opinion of the EOR and Owner, it conforms to the specification in all respects except manufacturer, model, and minor details. Material variances will not be allowed.
 - b. Alternate equipment which is a "standard product" of the manufacturer shall be modified, re-designed, or furnished with special features or special materials as may be necessary to conform to the requirements of this specification and contract drawings.
 - c. The Owner reserves the right to decide whether or not the proposed alternate will be acceptable.
2. The Contract, if awarded, will be on the basis of material and equipment specified without consideration of alternate equipment. In the event an alternate is allowed, the Contract price will be adjusted accordingly by a Change Order.
 - a. By submitting a bid, the Contractor agrees and understands that Contract award will be made on the basis of the specified equipment.
 - b. If an alternate is found to be not acceptable, the Contractor shall be responsible for supplying the equipment specified.

PART 2 - MATERIALS

2.1 GUIDES: T-304/316 Stainless steel/FRP.

2.2 STOP LOGS: Fiberglass Reinforced Polyester (FRP) totally encapsulating an

internal- reinforcing structure. To assure maximum service life, the copolymer composite shall be ultraviolet stabilized and seamless to protect inner structural members from corrosion. Structural characteristics for a 1/8-inch glass mat laminate shall meet the following minimum physical properties.

Tensile strength	14,700 psi
Flexural modulus	800,000 psi
Flexural strength	23,300 psi
Impact strength	9.0 ft-lbs./in
Water absorption	<0.13% (in 24 hours)

2.3 LIFTING PINS OR LIFTING EYES: T-304/316 Stainless Steel.

2.4 STOP LOG AND IN-CHANNEL SEALS: All seals shall be molded of extruded virgin neoprene per ASTM D-2000. The following physical characteristics apply:

Specific gravity	1.25
Hardness	55-65 Shore A Durometer
Tensile strength	1,500 psi
Elongation	300%
Low temperature brittleness	-40° F

2.5 STOP LOG LIFTING BEAM: A lifting beam with automatic latching hooks shall be provided for stop logs that weigh more than 75 pounds. The lifting beam shall be built in such a manner as to automatically latch on to the stop logs when lowered into the guide frame. The lifting beam shall also have a tagline release mechanism. Hook pins shall be made of T- 304/316 stainless steel. The beam and hooks shall be of galvanized steel.

PART 3 - CONSTRUCTION

3.1 STOP LOGS: Each log shall be molded individually to the exact dimensions specified. Stop logs shall be manufactured of reinforced thermoset plastic containing ultraviolet absorbers. The surface shall be resin-rich to a depth of 0.010 inches to 0.020 inches and reinforced with C-glass or polymeric fiber surfacing material. The surface shall be free of exposed reinforcing fibers. The composition of these layers shall be approximately 95% (by weight) resin. The remaining laminate shall be made up of copolymer composite and reinforcing fibers in a form, orientation and position to meet the mechanical requirements. Structural reinforcing shall be utilized to attain the necessary stiffness to meet

deflection requirements, and shall be well encapsulated with a laminate not less than 1/4 inch thick on each side to insure against any permeation by water to the core area. T-304/316 stainless steel lifting (*pins/eyes*) shall be fastened to the log with sufficient reinforcing to withstand the lifting force.

- 3.2 SEALS: The stop logs shall be equipped with elastomeric bottom seals to seal between the logs. A special labyrinth seal shall also be fastened to the guide to form a watertight joint with the stop logs. Seals shall be made of molded or extruded virgin neoprene having a hardness of 55 - 65 Shore A Durometer, conforming to ASTM D-2000, with a maximum compression set of 25 %, and low temperature brittleness to meet suffix F-17 (-40°F).
- 3.3 GUIDES: Guides shall be styled for embedment, wall mounting or in-channel mounting as needed to meet project requirements. Guides shall be fabricated from T-304/316 stainless steel or fiberglass and shall have a slot suitable for mating with the stop log. Guides to be bolted to the head wall shall be equipped with heavy-duty mounting angle for ease of mounting to the channel wall by means of T-304/316 stainless steel anchor bolts. Inverts shall be flush with the channel bottom.

Guides shall be fitted with a neoprene seal having two raised seating points fastened to the guide with a UHMW clamping bar and stainless steel flat head machine screws. Seals shall be on each side of the guide groove.

PART 4 - INSTALLATION

- 4.01 All stop logs shall be installed by skilled workers in accordance with the plans and specifications, and in full conformity with the instructions and recommendations of the equipment manufacturer.

Please consult your local representative or

Plasti-Fab, Inc.

PO Box 100

Tualatin, OR 97062

Phone: 503-692-5460 Fax: 503-692-1145

E-MAIL: SALES@PLASTI-FAB.COM

WEB: WWW.PLASTI-FAB.COM

END OF SECTION

SECTION 43 07 00

TRENCH DRAIN

PART 1 - GENERAL

1.1 SCOPE OF WORK

Provide and install the trench drain system for the tank pavilion as indicated on the Construction Drawings.

1.2 DESCRIPTION

The Contractor will purchase and install the trench drain system as indicated on Sheet M-1 of the Construction Drawings. Alternate designs must be accompanied by Shop Drawings and engineering calculations, signed and sealed by an engineer registered in the State of Florida. The trench drain system must be embedded in the concrete pad and connected to the point of discharge.

1.3 MATERIALS

- A. The trench drain channel shall be constructed of glass fiber polyester with interlocking channel sections.
- B. The trench drain shall have an A Class HDPE perforated grate top
- C. Additional end caps, connectors, outlets, and miscellaneous brackets shall be provided, as necessary, to produce a working drainage system
- D. Trench drain shall be manufactured by Josam Pro-Plus Trench Drain System (Norfolk, Virginia; Phone: 877-903-7246) or approved equal

1.4 SUBMITTALS

A. SHOP DRAWINGS

- 1. Shop drawings shall be submitted to the EOR for approval. Shop drawings shall include dimensional layouts, materials, details of appurtenances, anchoring, installation, and operation instructions. Fabrication and installation shall be in accordance with such approved drawings.

2. A digital copy (PDF) of the manufacturer's operation, installation, and maintenance manual shall be submitted for approval prior to shipment of the equipment.

B. ALTERNATE EQUIPMENT

1. If the Contractor desires to offer equipment as an alternate to the specified equipment, he shall submit (within 14 days after the bid opening) substantial descriptive information in order that the EOR may determine if the proposed alternate is equal or superior quality to that specified.
 - a. No alternate will be considered unless, in the opinion of the EOR and Owner, it conforms to the specification in all respects except manufacturer, model, and minor details. Material variances will not be allowed.
 - b. Alternate equipment which is a "standard product" of the manufacturer shall be modified, re-designed, or furnished with special features or special materials as may be necessary to conform to the requirements of this specification and contract drawings.
 - c. The Owner reserves the right to decide whether or not the proposed alternate will be acceptable.
2. The Contract, if awarded, will be on the basis of material and equipment specified without consideration of alternate equipment. In the event an alternate is allowed, the Contract price will be adjusted accordingly by a Change Order.
 - a. By submitting a bid, the Contractor agrees and understands that Contract award will be made on the basis of the specified equipment.
 - b. If an alternate is found to be not acceptable, the Contractor shall be responsible for supplying the equipment specified.

END OF SECTION

SECTION 43 08 00

EYE WASH SAFETY STATIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

Provide and install protective eye wash safety stations as indicated on the Construction Drawings. Work includes connection to potable water to provide operable system.

1.2 DESCRIPTION

The Contractor will purchase and install eye/face safety wash stations as indicated on Sheets M-1 and M-2 of the Construction Drawings. Alternate designs must be accompanied by Shop Drawings and engineering calculations, signed and sealed by an engineer registered in the State of Florida.

1.3 MATERIALS

A. ALUM TANK PAVILION

1. Eye/face wash station shall be pedestal-mounted with corrosion-resistant paint
2. Wash bowl shall be constructed of green ABS plastic with 11-inch bowl
3. Stand pipe shall be 1-1/4-inch hot-dipped galvanized steel with 9-inch diameter floor flange with green corrosion-resistant epoxy coating
4. Yellow plastic pop-off dust cover for eyewash head
5. Inlet: 1/2-inch IPS, waste: 1-1/4-inch IPS
6. Unit shall be Haws Model 7261 CRP Axion MSR Corrosion-Resistant Eye Wash Station

B. CONTROL ROOM

1. Eye/face wash shall be a pull-off wall-mounted design

2. Spray unit: wall-mounted holder with 12 ft of recoil hose pressure tested at 200 psi
3. Operation: achieve full continuous flow while lever is squeezed
4. Vacuum Breaker: equipped with chrome-plated brass vacuum breaker
5. Unit shall be Haws Model 8905 MSR Wall Mount Eye/Face Wash

1.4 SUBMITTALS

A. SHOP DRAWINGS

1. Shop drawings shall be submitted to the EOR for approval. Shop drawings shall include dimensional layouts, materials, details of appurtenances, anchoring, installation, and operation instructions. Fabrication and installation shall be in accordance with such approved drawings.
2. A digital copy (PDF) of the manufacturer's operation, installation, and maintenance manual shall be submitted for approval prior to shipment of the equipment.

B. ALTERNATE EQUIPMENT

1. If the Contractor desires to offer equipment as an alternate to the specified equipment, he shall submit (within 14 days after the bid opening) substantial descriptive information in order that the EOR may determine if the proposed alternate is equal or superior quality to that specified.
 - a. No alternate will be considered unless, in the opinion of the EOR and Owner, it conforms to the specification in all respects except manufacturer, model, and minor details. Material variances will not be allowed.
 - b. Alternate equipment which is a "standard product" of the manufacturer shall be modified, re-designed, or furnished with special features or special materials as may be necessary to conform to the requirements of this specification and contract drawings.
 - c. The Owner reserves the right to decide whether or not the proposed alternate will be acceptable.

2. The Contract, if awarded, will be on the basis of material and equipment specified without consideration of alternate equipment. In the event an alternate is allowed, the Contract price will be adjusted accordingly by a Change Order.
 - a. By submitting a bid, the Contractor agrees and understands that Contract award will be made on the basis of the specified equipment.
 - b. If an alternate is found to be not acceptable, the Contractor shall be responsible for supplying the equipment specified.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 43 09 00

pH MONITORING SYSTEM

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. The Contractor shall provide all labor, material, and equipment to furnish and install a microprocessor-based automatic, continuous pH monitoring system, as shown on the contract drawings and as specified herein.
- B. WORK AND COMPONENTS INCLUDED

The equipment manufacturer shall furnish the items listed below:

1. pH and temperature sensor
2. Digital display
3. Controller enclosure
4. In-line Tee probe holder
5. Supports
6. All necessary associated PVC piping inside the Control Building

1.2 QUALIFICATIONS

- A. Manufacturer
 1. It is the intention of this specification to cover minimum acceptable quality for a complete microprocessor-based pH controller installation with the exception of motor controls, electrical work, and piping requirements.
 2. Part numbers or trade names are used in this specification only to facilitate the general configuration and description of the equipment desired and in no way implies that equal equipment of other manufacturers cannot be used. Products of other manufacturers will be considered in accordance with the Alternate Equipment section of this specification.

B. Manufacturer's Experience

1. The equipment manufacturer shall have not less than ten (10) successful years experience in the design and manufacture of microprocessor-based pH controllers.
2. The EOR may require evidence, in the form of operating records, from these plants to substantiate any claims concerning the ability of the equipment to perform as required.

1.3 SUBMITTALS

A. Shop Drawings

1. Shop drawings shall be submitted to the EOR for approval. Shop drawings shall include dimensional layouts, materials, details of appurtenances, anchoring, installation, and operation instructions. Fabrication and installation shall be in accordance with such approved drawings.
2. Five (5) copies of the manufacturer's operation, installation, and maintenance manual shall be submitted for approval prior to shipment of the equipment.

B. Alternate Equipment

1. If the Contractor desires to offer equipment as an alternate to the specified equipment, he shall submit, within 14 days after the bid opening, substantial descriptive information in order that the EOR may determine if the proposed alternate is equal or superior quality to that specified.
 - a. No alternate will be considered unless, in the opinion of the EOR and Owner, it conforms to the specification in all respects except manufacturer, model, and minor details. Material variances will not be allowed.
 - b. Alternate equipment which is a "standard product" of the manufacturer shall be modified, redesigned, or furnished with special features or special materials as may be necessary to conform to the requirements of this specification and contract drawings.
 - c. The Owner reserves the right to decide whether or not the proposed alternate will be acceptable.

2. The Contract, if awarded, will be on the basis of material and equipment specified without consideration of alternate equipment. In the event an alternate is allowed, the Contract price will be adjusted accordingly by a Change Order.
 - a. By submitting a bid, the contractor agrees and understands that Contract award will be made on the basis of the specified equipment.
 - b. If an alternate is found to be not acceptable, the contractor shall be responsible for supplying the equipment specified.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The design and layout shown on the design plans are based on the manufacturer shown in Section 2.02.
- B. If equipment other than that of the manufacturer shown is submitted to the EOR for consideration as an equal, it shall be the responsibility of the Bidder wishing to make the substitution to submit with the request a revised drawing of the mechanical equipment and basin layouts acceptable to the EOR. This revised drawing shall show the proposed location of the substitute unit, and area required for withdrawal space of replacement or serviceable components. This drawing shall also show clearances of adjacent equipment and service area required by that equipment.
- C. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the Bidder wishing to make the substitution. This shall include the cost of redesign by affected designers. Any additional cost incurred by affected subcontractors shall be the responsibility of the Bidder and not the Owner.

2.2 MANUFACTURERS

Yokogawa (Phone: 800-888-6400) or approved equal

2.3 EQUIPMENT SPECIFICATIONS

- A. pH Sensor: The pH sensor shall have the following specifications

1. Measuring Elements
 - a. pH glass electrode
 - b. Silver/Silver chloride reference
 - c. Solid platinum electrode
 - d. Temperature sensor
2. Construction Materials
 - a. Body: PPS 40GF
 - b. Sensor: G Glass
 - c. Earth Pin: solid platinum
 - d. Reference Junction: porous PTFE
 - e. O-Ring: Viton
3. Operating Range
 - a. pH: 0-14
 - b. Temperature: -10-105 °C
 - c. Conductivity: >10 \square mho/cm

B. Sensor shall be Yokogawa Model FU-24-VP-TI-NPT or approved equal. Local Display: A local display shall be provided to continuously display pH values

1. Modular display unit: wall-mounted
2. Touch screen display
3. Capable of self-diagnostics for attached probes
4. Capable of monitoring two separate probes
5. Sensor status display and maintenance time
6. Plastic outer case with polycarbonate window
7. Display: black/white LCD with touch screen
8. Power: 24 volt DC loop

9. Output: One 4-20 mA output
10. Display shall be Yokogawa Model FLXA-21

C. Sensor Holder

1. Holder shall be in-line T flow-through for selected sensor

PART 3 - EXECUTION

3.1 INSTALLATION AND STARTUP

- A. The pH controller shall be installed in accordance with the manufacturer's recommendations and instructions to provide a complete installation.
- B. A manufacturer-approved technician shall provide startup services on the project site to check the pH controller and appurtenances for proper installation, electrical control connection and operation, and to instruct the owner's personnel on operation and maintenance requirements.

END OF SECTION

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SECTION 43 10 00

POTABLE WATER SERVICE AND PLUMBING

PART 1 - GENERAL

1.1 SCOPE OF WORK

The Contractor shall furnish and install a potable water service and associated plumbing and fixtures as indicated on the Construction Drawings.

1.2 DESCRIPTION

Installation of potable water service and building plumbing shall conform to the requirements of the local utility providing the service connection and to the Construction Drawings. If a conflict exists between requirements of the local utility and the Construction Drawings, the local utility requirements will govern the installation. The local utility will be responsible for providing a service connection from the main service line into the project site and setting a meter and meter box. The Contractor shall be responsible for extending the service from the meter to the building including any required backflow or other control devices using materials and sizes acceptable to the water provider. Contractor shall also furnish and install all associated plumbing and fixtures as indicated on the Construction Drawings.

END OF SECTION

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