



# RAW WATER BOOSTER PUMP STATION IMPROVEMENTS

Supplemental Technical Specifications – 100% Design

PREPARED BY



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**SUPPLEMENTAL TECHNICAL SPECIFICATIONS**

**Note: The following Technical Specifications shall be incorporated into the Contract Documents for the Raw Water Booster Pump Station Improvements project. In addition to these Supplemental Technical Specifications, the Collier County Utility Standards Manual shall apply to this project. Where a conflict exists between the two sets of specifications, the more stringent requirement shall apply.**

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SECTION 01010  
SUMMARY OF WORK

PART 1            GENERAL

1.1            SECTION INCLUDES

- A.      Description of Work
- B.      CONTRACTOR's Use of Site
- C.      Work Sequence
- D.      COUNTY Occupancy

1.2            DESCRIPTION OF WORK

A.      General:

The Work covered under this contract includes but is not limited to the following:

- 1.      Conversion of a portion of the existing building for an office space for the Public Utilities staff.
- 2.      Expansion of the existing restroom to include a shower.
- 3.      Drilling a potable water supply well.
- 4.      Installation of a small scale (approximately 20 GPM) Reverse Osmosis system with odor control and chemical injection to supply potable water to the restroom. The proposed RO system will connect to the proposed water supply well.
- 5.            The Contractor shall locate, clean, and inspect the septic tank, distribution box, and leach field piping.
- 6.      Demolition, removal, and replacement of the existing flow meter with a new meter. The new meter and assembly (piping, fitting, and valves) will be furnished and installed by the Contractor.
- 7.      Installation of a Pre-Engineered Metal Building (PEMB) semi-enclosed parking canopy over an existing concrete slab.
- 8.      Miscellaneous mechanical, electrical, and plumbing improvements associated with the construction described above.

B. The Work includes:

1. Furnishing of all labor, a portion of the materials, all 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. Sole responsibility for adequacy of plant and equipment.
3. Maintaining the Work area and site in a clean and acceptable manner.
4. Protection of finished and unfinished Work.
5. Repair and restoration of Work or existing facilities 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.

Implied and Normally Required Work: It is the intent of these Specifications to provide the COUNTY 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.

- C. 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 CONTRACTOR'S USE OF SITE

- A. Limit use of site and premises for work and storage to allow for the following:

1. 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.

2. COUNTY occupancy and access to operate existing facilities.
3. Coordination of site use with ENGINEER.
4. Responsibility for protection and safekeeping of products under this CONTRACT.
5. Providing additional off-site storage at no additional cost to the COUNTY as needed.

#### 1.4 WORK SEQUENCE

- A. The Raw Water Booster Pump Station (RWBPS) timing for shutdown is critical. The contractor shall coordinate with the RWBPS operators as follows:
  - a. January through May the allowable time is 8 hours for a shutdown of the station
  - b. June through September the allowable time is 24 hours for a shutdown of the station
  - c. October through December the allowable time is 12 hours for a shutdown of the station

The Contractor must propose Construction Sequencing Plan for review and approval by the County and Engineer.

- B. The Contractor shall be fully responsible to provide all necessary materials, pumps (if necessary), piping, tools, etc. to accomplish the necessary bypass efforts.

Coordinate Work of all subcontractors.

#### 1.5 COUNTY OCCUPANCY

- A. The COUNTY will occupy premises during entire period of construction in order to maintain normal operations. Cooperate with the COUNTY's Manager or designee in all construction operations to minimize conflict, and to facilitate COUNTY usage.
- B. Conduct operations with the least inconvenience to the general public.

#### 1.6 PROTECTION OF EXISTING UTILITIES

- A. In case of damage to existing utilities caused by construction activities, contact the owner of the utility or appropriate COUNTY department (Water or Wastewater) immediately. Repair any damage to existing utilities caused by construction activities in coordination with or as directed by the owner of the utility.

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 01025

### MEASUREMENT AND PAYMENT

#### PART 1- GENERAL

##### 1.01 DESCRIPTION

- A. This section describes the method used to determine quantities of Work performed or materials supplied for which a price is given in the Bid. It establishes the basis upon which payment will be made for Payment Items.
- B. Subject to the provisions in General Conditions, all Work and payment for the Work is represented by Payment Items and associated unit prices.

##### 1.02 PAYMENT

- A. Subject to all other contract requirements, the Contractor shall be paid for "as-built" quantities of Work for which a price is given in the bid.
- B. Quantities on the Bid Form are for comparison in competitive bidding only and do not constitute the basis for payment or measurement of quantities.
- C. Quantities on the Bid Form are estimated and may be increased or decreased without limit.
- D. No separate payment will be made for one Payment Item as Work incidentally required to complete the Work of another.
- E. Payment for Work performed shall be made in accordance with the unit prices in the Bid. Retainage shall apply to all Contractor payments prior to final acceptance.

##### 1.03 MEASUREMENT FOR PAYMENT

- A. Methods of Measurement:
  - 1. Measurements of lengths, widths, slope angles, and depths or elevations shall be made to determine "as-built" quantities of lengths, areas and volumes pertinent to Payment Items.
    - a. Unless otherwise specified, all lengths shall be horizontal distances.
    - b. Slope angles and elevations shall be measured using land surveying equipment.

2. Graphic representations of measured quantities shall be drafted to scale using the Drawings where convenient and appropriate. Additional drawings shall be drafted if required.
    - a. Irregular shapes representing areas and volumes shall be measured using a compensating polar planimeter or a computer digitizer.
    - b. Regular shapes shall be scaled.
  3. Use of Drawings:
    - a. Unless otherwise agreed upon between the Contractor and Owner, the Drawings shall be used as the basis to establish existing grades and other existing topographic features.
- B. Payment limits where Payment Lines are not shown on the Drawings:
1. Pipe Length: Measurement of pipe shall be made along the top of pipe, excluding valves, in place, taken as the laying length. Pipe length shall include fittings.
  2. Except as specified otherwise, measurements of Payment Item quantities of weights, lengths, areas and volumes shall be made:
    - a. On "as-built" and in-place completed Work, during construction or at the time of Substantial Completion.
    - b. If no other feasible and practical methods of measurements are available, by delivery slips delivered to the Engineer.
  3. Adjustments shall be made to eliminate overlaps in area and volume measurements.

#### 1.04 PAYMENT ITEMS

- A. Separate payment will be made for the Unit Price and Lump Sum items listed on the Bid Form. Related work not specifically listed or identified below in 1.04 B and C, but evidently necessary for satisfactory completion of the Item shall be considered to be included.
- B. No separate payment will be made for the following Work, and its cost shall be included in the Bid Price of the Payment Item to which it is associated:
  1. Trench excavation, sheeting, shoring and bracing.
  2. De-watering, erosion and sedimentation control, and turbidity screening.

3. Removal, replacement and restoration of culverts and storm sewer pipe crossings of driveways and roads.
4. Cleanup.
5. Testing, including all materials and equipment.
6. Maintenance of utility service.
7. Appurtenant work.
8. Record Drawings.
9. Field Office.
10. Saw cutting.
11. Coordination with other contractors.
12. Layout of the work.
13. Notifications to property owners of construction schedule and service interruptions.
14. Restoration and Sodding
15. Removal or breaking of rock

C. Measurement and Payment Items as listed in the Bid Schedule:

**1. Mobilization/Demobilization (Bid Item No. 1)**

Preparatory Work and operations in mobilizing for beginning work on the Project and demobilizing for ending work on the Project. The establishment of field offices, buildings, safety equipment, first aid supplies, sanitary and other facilities, as required by these Specifications, State and local laws and any other preconstruction expense necessary for the state of the Work; the cost of field engineering, including permits and fees, construction schedules, construction photographs, project signs, shop drawings, temporary facilities, lay down storage area, construction aids, work associated with Contractor support during Owner testing, reviews and inspection, re-inspection and any rework resulting from same, cleaning, erosion and sediment control, surveyed project as-built documents, operating and maintenance data. The Contractor shall submit invoices substantiating the cost of mobilization with each pay request. Payment for mobilization / demobilization shall be as follows: 75% shall be paid at the time of first invoice after the Contractor has mobilized to the site and established field operations. The remaining 25% shall be paid at the completion of the project when the contractor has properly demobilized, cleaned the site, and completed all restoration.

**2. General Requirements (Insurance, Bonds, Permits) (Bid Item No. 2)**

- a. Measurement of various items for General Requirements will not be made for payment and all items shall be included in the appropriate lump sum prices throughout the bid schedule.

- b. Payment for General Requirements shall include Insurance requirements costs, the costs of all bonds, and all administrative costs associated with acquiring and maintaining the necessary coverage as described in the Contract Documents, and the cost of obtaining any permits as required for construction.

**3. Flow Meter and Piping Replacement including Bypass Pumping and Demolition (Including Electrical) (Bid Item No. 3)**

- a. Measurement for various items covered under Flow Meter and Piping Replacement including Bypass Pumping and Demolition (Including Electrical) will not be made for payment, and all items shall be included in the lump sum price.
- b. Payment for Flow Meter and Piping Replacement including Bypass Pumping and Demolition will be made at the Contract lump sum price for each item, which shall be full compensation for all labor, materials, equipment services, testing, and other necessary work as specified in the Drawings and Specifications. This includes demolition and removal of existing process piping, abandonment of yard piping, removal and disposal of meter vault and piping, demolition of concrete trench walls and pipe penetrations, and all other required items including all electrical work. Additionally, payment covers temporary piping and electrical work to maintain pumping operations. It also includes above ground piping, proposed valves, flow meter, fittings, pipe supports, formwork, cast-in-place concrete, paints and coatings, disinfection and pressure testing, as well as buried pipe and fittings, valves, restraining devices, labels, and all testing. Payment will be based on the percentage of work completed during the pay period, rounded to the nearest 10%, and the cumulative total shall not exceed the Lump Sum Bid Pay Item amount.

**4. Wastewater Subsurface Disposal System Cleaning and Inspection (Bid Item No. 4)**

- a. Measurement for various items covered under Wastewater Subsurface Disposal System Cleaning and Inspection will not be made for payment, and all items shall be included in the lump sum price.
- b. Payment for Wastewater Subsurface Disposal System Cleaning and Inspection will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for all labor, materials, tools, and equipment services required. This includes but is not limited to: locating, cleaning, and inspection of all components, pumping out septic tank, inspection report, confirming the ability of the septic tank to accommodate the proposed improvements to the

restroom and all other items shown on the Drawings and specified herein. Payment will be based on percentage of work completed during pay period at time of pay application to the nearest 10% complete. The cumulative total shall not exceed the Lump Sum Bid Pay Item amount.

**5. Potable Well, 1" HDPE Water Main, Valves, and Reverse Osmosis (RO) System (Including Electrical) (Bid Item No. 5)**

- a. Measurement for various items covered under Potable Well, 1" HDPE Water Main, Valves, and Reverse Osmosis (RO) System (Including Electrical) will not be made for payment, and all items shall be included in the lump sum price.
- b. Payment for Potable Well, 1" HDPE Water Main, Valves, and Reverse Osmosis (RO) System will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for all labor, materials, tools, and equipment services required. This includes but is not limited to: drilling potable well, installing 1" HDPE water main and connecting from well to RO system, installing valves, installing RO system, connecting them to the existing restroom and all other items including all electrical work shown on the Drawings and specified herein. Payment will be based on percentage of work completed during pay period at time of pay application to the nearest 10% complete. The cumulative total shall not exceed the Lump Sum Bid Pay Item amount.

**6. Pre-Engineered Metal Building (PEMB) for Parking Canopy (Including Mechanical and Electrical) (Bid Item No. 6)**

- a. Measurement for various items covered under Pre-Engineered Metal Building (PEMB) for Parking Canopy (Including Mechanical and Electrical) will not be made for payment, and all items shall be included in the lump sum price.
- b. Payment for Pre-Engineered Metal Building (PEMB) for Parking Canopy (Including Mechanical and Electrical) shall be made at the Contract lump sum price, which price and payment shall be full compensation for all labor, all materials, tools, and equipment services required. This includes but is not limited to: construction of the Pre-Engineered Metal Building and all other items necessary to complete the Pre-Engineered Metal Building including all mechanical and electrical work shown on the Drawings and specified herein. Payment will be based on percentage of work complete during the pay period at time of pay application to the nearest 10% complete. The cumulative total shall not exceed the Lump Sum Bid Pay Item amount.

**7. Office Space Improvements (Including Mechanical and Electrical) (Bid Item No. 7)**

- a. Measurement for various items covered under Office Space Improvements (Including Mechanical and Electrical) will not be made for payment, and all items shall be included in the lump sum price.
- b. Payment for Office Improvements will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for all labor, select materials, all tools, and equipment as shown on the Drawings and specified herein. This includes but is not limited to: installing desks, electrical, mechanical and all other items to complete the office improvements. Payment will be based on percentage of work completed during the pay period at time of pay application to the nearest 10% complete. The cumulative total shall not exceed the Lump Sum Bid Pay Item amount.

**8. Restroom Improvements (Including Mechanical, Electrical, and Plumbing) (Bid Item No. 8)**

- a. Measurement for various items covered under Restroom Improvements (Including Mechanical, Electrical, and Plumbing) will not be made for payment, and all items shall be included in the lump sum price.
- b. Payment for Restroom Improvements will be made at the Contract lump sum price for the item, which price and payment shall be full compensation for all labor, select materials, all tools, and equipment as shown on the Drawings and specified herein. This includes but is not limited to: installing shower, water heater, mechanical, electrical, plumbing and all other items to complete the bathroom improvements. Payment will be based on percentage of work completed during the pay period at time of pay application to the nearest 10% complete. The cumulative total shall not exceed the Lump Sum Bid Pay Item amount.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

## SECTION 01041

### PROJECT COORDINATION

#### PART 1 – GENERAL

##### 1.01 REQUIREMENTS INCLUDED

###### A. The Contractor shall:

1. Coordinate work of his own employees and subcontractors.
2. Expedite his work to assure compliance with schedules.
3. Comply with orders and instructions of Engineer.
4. Provide 24 hour/7 days a week contact information for the project superintendent, who shall be no more than 30 minutes from the project site during the duration of the project (that is a 30 minute response time). Additionally, the project superintendent shall have the equipment/manpower available (with a 30 minute response time) to respond to all problems which may occur at the site from the start of work to approval of the work.
5. Once work begins, the Contractor shall continually work on the project until it is complete and shall not de-mobilize from the site or stop work for excessive periods of time.

##### 1.02 RELATED REQUIREMENTS

- A. Section 01010: Summary of Work.
- B. Section 01152: Application for Payment.
- C. Section 01200: Project Meetings.
- D. Section 01310: Construction Schedules.
- E. Section 01340: Shop Drawings, Product Data and Samples.
- F. Section 01500: Construction Facilities and Temporary Controls.
- G. Section 01700: Contract Closeout.

##### 1.03 CONSTRUCTION ORGANIZATION AND START-UP

- A. Engineer shall establish on-site lines of authority and communications:

1. Schedule and conduct preconstruction meeting and progress meetings as specified in Section 01200.
2. Establish procedures for:
  - a. Submittals.
  - b. Reports and records.
  - c. Recommendations.
  - d. Coordination of drawings.
  - e. Schedules.
  - f. Resolution of conflicts.
3. Interpret Contract Documents:
  - a. Transmit written interpretations to Contractor, and to other concerned parties.
4. Assist in obtaining permits and approvals:
  - a. Verify that contractor and subcontractors have obtained inspections for Work and for temporary facilities.
5. Control the use of Site:
  - a. Allocate space for Contractor's use for field offices, sheds, and work and storage areas.
6. Review and Testing:
  - a. Review work for general performance in accord with requirements of Contract Documents.
  - b. Administer special testing and inspections of suspect Work.
  - c. Reject Work which does not comply with requirements of Contract Documents.

#### 1.04 CONTRACTOR'S DUTIES

- A. Construction Schedules:
  1. Prepare a detailed schedule of basic operations prior to beginning work for the review and approval of the Engineer.
  2. Monitor schedules as work progresses:
    - a. Identify potential variances between scheduled and probable completion dates for each phase.
    - b. Recommend to Owner adjustments in schedule to meet required completion dates.



- c. Document changes in schedule; submit to Owner, Engineer and to involved subcontractors.
- 3. Observe work of each subcontractor to monitor compliance with schedule.
  - a. Verify that labor and equipment are adequate for the work and the schedule.
  - b. Verify that product procurement schedules are adequate.
  - c. Verify that product deliveries are adequate to maintain schedule.
  - d. Report noncompliance to Engineer, with recommendation for changes.
- B. Process Shop Drawings, Product Data and Samples:
  - 1. Prior to submittal to Engineer, review for compliance with Contract Documents:
    - a. Field dimensions and clearance dimensions.
    - b. Relation to available space.
    - c. Effect of any changes on the work of any subcontractor.
- C. Review Drawings prepared by subcontractors:
  - 1. Prior to submittal to Engineer, review for compliance with Contract Documents.
- D. Prepare Coordination Drawings as required to resolve conflicts and to assure coordination of the work of, or affected by, mechanical and electrical trades, or by special equipment requirements.
  - 1. Submit to Engineer.
  - 2. Reproduce and distribute copies to concerned parties after Engineer review.
- E. Maintain Reports and Records at Job Site, available to Engineer and Owner.
  - 1. Daily log of progress of work.
  - 2. Records:
    - a. Contracts.
    - b. Purchase orders.
    - c. Materials and equipment records.

d. Applicable handbooks, codes and standards.

F. Maintain file of record documents

#### 1.05 CONTRACTOR'S CLOSE-OUT DUTIES

A. Mechanical and Electrical equipment start-up:

1. Coordinate check-out of utilities, operational systems and equipment.
2. Organize initial start-up and testing.
3. Record dates of start of operation of systems and equipment.
4. Submit to Owner written notice of beginning of warranty period for equipment put into service.

B. At completion of Work, conduct an inspection to assure that:

1. Specified cleaning has been accomplished.
2. Temporary facilities have been removed from site.

C. Substantial Completion:

1. Conduct an inspection to develop a list of Work to be completed or corrected.
2. Assist Engineer in inspection.
3. Supervise correction and completion of work of subcontractors.

#### 1.06 ENGINEER'S CLOSE-OUT DUTIES

A. Final Completion:

1. When Contractor determines that Work is finally complete, conduct an inspection to verify completion of Work.

B. Administration of Contract closeout:

1. Receive and review contractor's final submittals.
2. Transmit to Owner with recommendations for action.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

## SECTION 01050

### FIELD ENGINEERING AND SURVEYING

#### PART 1 – GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. Provide and pay for field engineering services required for Project.
  - 1. Survey work required in execution of Project.
  - 2. Civil, structural or other professional engineering services specified, or required to execute Contractor's construction methods.
- B. Owner's Representative will identify existing control points indicated on the Drawings, as required.

##### 1.02 RELATED REQUIREMENTS

- A. General Conditions.
- B. Section 01010: Summary of Work.
- C. Section 01700: Contract Closeout.

##### 1.03 QUALIFICATIONS OF SURVEYOR OR ENGINEER

- A. Qualified engineer or land surveyor, registered in the State of Florida and acceptable to Owner.

##### 1.04 SURVEY REFERENCE POINTS

- A. Establish basic horizontal and vertical control points for the Project prior to starting work.
- B. Locate and protect control points prior to starting site work, and preserve all permanent reference points during construction.
  - 1. Make no changes or relocations without prior written notice to Engineer.
  - 2. Report to Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
  - 3. Require Surveyor to replace project control points which may be lost or destroyed.
    - a. Establish replacements based on original survey control.

##### 1.05 PROJECT SURVEY REQUIREMENTS

- A. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means:
  - 1. Site improvements
    - a. Stakes for grading, fill and topsoil placement.
    - b. Utility slopes and invert elevations.
  - 2. Batter boards for structures.
  - 3. Controlling lines and levels required for mechanical and electrical trades.
- B. From time to time, verify layouts by same methods.
- C. Locate and mark all known underground utilities prior to entrance of any equipment on the site. All such utilities shall be protected from heavy traffic. Establish and maintain barricades around all manholes, drains, and similar underground items. Immediately notify the Owner of any conflict between operations and any in ground item to remain.

#### 1.06 RECORDS

- A. Maintain a complete, accurate log of all control and survey work as it progresses.
- B. At the end of the project, submit a certified site survey at 1 inch equals 30 feet scale on reproducible tracing sheets 24 inches by 36 inches. Survey shall include: all topographic features, slab and asphalt elevations at least every 100 feet, and top of all buried pipe and conduit at least every 50 feet, and at all changes in vertical or horizontal direction, locations of all valves, casings, air release valves, and all other components installed.

#### 1.07 SUBMITTALS

- A. Submit name and address of Registered Surveyor to Engineer.
- B. On request of Engineer, submit documentation to verify accuracy of field engineering work.

#### PART 2 – PRODUCTS (NOT USED)

#### PART 3 – EXECUTION (NOT USED)

END OF SECTION

## SECTION 01090

### REFERENCE STANDARDS

#### PART 1 – GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. Abbreviation and acronyms used in Contract Documents to identify reference standards.

##### 1.02 QUALITY ASSURANCE

- A. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
- B. Publication Date: The publication in effect on the date of issue of Contract Documents, except when a specific publication date is specified.

##### 1.03 ABBREVIATIONS, NAMES, AND ADDRESSES OF ORGANIZATIONS

- A. Obtain copies of referenced standards direct from publication source, when needed for proper performance of Work, or when required for submittal by Contract Documents.

AA	Aluminum Association 818 Connecticut Avenue, N.W. Washington, DC 20006
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AABC	Associated Air Balance Council 1000 Vermont Avenue, N.W. Washington, DC 20005
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AASHTO	American Association of State Highway & Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001
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ACI	American Concrete Institute Box 19150 Redford Station Detroit, MI 48219
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ADC	Air Diffusion Council 435 North Michigan Avenue Chicago, IL 60611
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AISC	American Institute of Steel Construction 1221 Avenue of the Americas New York, NY 10020
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, DC 20036
AMCA	Air Movement and Control Association 30 West University Drive Arlington Heights, IL 60004
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
ARI	Air-Conditioning and Refrigeration Institute 1815 North Fort Myer Drive Arlington, VA 22209
ASHRAE	American Society of Heating, Refrigeration & Conditioning Engineers 345 East 47th Street New York, NY 10017
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASPA	American Sod Producers Association Association Building Ninth and Minnesota Hastings, NE 68901
ASTM	American Society of Testing & Materials 1916 Race Street Philadelphia, PA 19103

AWWA	American Water Works Association 6666 W. Quincy Avenue Denver, CO 80235
AWI	Architectural Woodwork Institute 2310 South Walter Reed Drive Arlington, VA 22206
AWPA	American Wood-Preserver's Association 7735 Old Georgetown Road Bethesda, MD 20014
AWS	American Welding Society 2501 NW 7th Street Miami, FL 33125
CDA	Cooper Development Association 57th Floor, Chrysler Building 405 Lexington Avenue New York, NY 10017
CLFMI	Chain Link Fence Manufacturers Institute 1101 Connecticut Avenue Washington, DC 20036
CRSI	Concrete Reinforcing Steel Institute 180 North LaSalle Street, Suite 2110 Chicago, IL 60601
MF	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407
GA	Gypsum Association 1603 Orrington Avenue Evanston, IL 60201



MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue
MLSFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NEBB	National Environmental Balancing Bureau 8224 Old courthouse Road Vienna, VA 22180
NEMA	National Electrical Manufacturer's Association 2101 L Street, N.W. Washington, DC 20037
NFPA	National Fire Protection Association 1619 Massachusetts Avenue, N.W. Washington, DC 20036
NTMA	National Terrazzo and Mosaic Association 3166 Des Plains Avenue Des Plains, IL 60018
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 20076
PCI	Prestressed Concrete Institute 20 North Wacker Drive Chicago, IL 60606
PS	Product Standard U.S. Department of Commerce Washington, DC 20203
RCSHSB	Red Cedar Shingle & Handsplit Shake Bureau 515 116th Avenue Bellevue, WA 98004

SDI	Steel Deck Institute Box 3812 St. Louis, MO 63122
SDI	Steel Door Institute 712 Lakewood Center North Cleveland, OH 44107
SIGMA	Sealed Insulating Glass Manufacturers Association 111 East Wacker Drive Chicago, IL 60601
SJI	Steel Joist Institute 1703 Parham Road, Suite 204 Richmond, VA 23229
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 8224 Old Court House Road Vienna, VA 22180
TAS	Technical Aid Series Construction Specifications Institute 1150 Seventeenth Street, NW Washington, DC 20036
TCA	Tile Council of America, Inc. Box 326 Princeton, NJ 08540
UL	Underwriter's Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

## SECTION 01152

### APPLICATION FOR PAYMENT

#### PART 1 – GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. Submit Applications for Payment to Engineer in accordance with the schedule established by Conditions of the Contract and herein.

##### 1.02 RELATED REQUIREMENTS

- A. Agreement between Owner and Contractor.
- B. Conditions of the Contract: Progress Payments, Retainage and Final Payment.
- C. Section 01370: Schedule of Values.
- D. Section 01700: Contract Closeout.

##### 1.03 FORMAT AND DATA REQUIRED

- A. Submit applications in the form required by Owner, in accordance with the example which will be provided by the Engineer, with itemized data typed on 8-1/2-inch x 11-inch white paper continuation sheets.
- B. Provide itemized data on continuation sheet:
  - 1. Format, schedules, line items and values: Those of the Schedule of Values accepted by Engineer.

##### 1.04 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

- A. Application Form:
  - 1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.
  - 2. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.
  - 3. Execute certification with signature of a responsible officer of Contract firm.
- B. Continuation Sheets:
  - 1. Fill in total list of all scheduled component items of Work, with item number and scheduled dollar value for each item.

2. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.
  - a. Round off values to nearest dollar, or as specified for Schedule of Values.
3. List each Change Order executed prior to date of submission at the end of the continuation sheets.
  - a. List by Change Order Number, and description, as for an original component item of work.

#### 1.05 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

- A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information, with a cover letter identifying:
  1. Project
  2. Application number and date.
  3. Detailed list of enclosures.
  4. For stored products:
    - a. Item number and identification as shown on application.
    - b. Description of specific material.
- B. Submit one copy of data and cover letter for each copy of application.

#### 1.06 PREPARATION OF APPLICATION FOR FINAL PAYMENT

- A. Fill in Application form as specified for progress payments.
- B. Use continuation sheet for presenting the final statement of accounting as specified in Section 01700-Contract Closeout.

#### 1.07 SUBMITTAL PROCEDURE

- A. Submit Applications for Payment to Engineer at the times stipulated.
- B. Number: 1 electronic copy of each Application.
- C. When Engineer finds Application properly completed and correct, he will transmit certificate for payment to Owner (the Clerk of Courts), with copy to Contractor.

#### PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

## SECTION 01200

### PROJECT MEETINGS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. The Contractor shall cooperate and coordinate with the Engineer to schedule and administer the preconstruction meeting, periodic progress meetings, and specifically called meetings throughout the progress of the Work. The Engineer shall:
  - a. Prepare agenda for meetings.
  - b. Make physical arrangements for meetings.
  - c. Preside at meetings.
  - d. Take and distribute meeting minutes.
2. Representatives of Contractor, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
3. The Owner shall attend meetings to ascertain that the Work is expedited consistent with Contract Documents and construction schedules.
4. Copies of the minutes of each progress meeting shall be distributed, by the Contractor, to the attendants within two business days after the meeting.

###### B. Related Requirements Described Elsewhere:

1. Construction Progress Schedules: Section 01310.
2. Shop Drawings, Working Drawings, and Samples: Section 01340.
3. Project Record Documents: Section 01720.

## 1.02 PRECONSTRUCTION MEETING

- A. Engineer will schedule a preconstruction meeting no later than ten (10) days after date of Notice to Proceed. The meeting shall be scheduled at the convenience of all parties.
- B. Location: A local site, convenient for all parties, designated by the Engineer.
- C. Attendance:
  - 1. Owner's representative.
  - 2. Engineer and his professional consultants.
  - 3. Resident project representative.
  - 4. Contractor and his superintendent.
  - 5. Major subcontractors.
  - 6. Representatives of major suppliers and manufacturers as appropriate.
  - 7. Governmental representatives as appropriate.
  - 8. Others as requested by the Contractor, Owner, and Engineer.
- D. The Engineer shall preside at the preconstruction meeting. The Engineer shall provide for keeping minutes and distribution of minutes to the Owner, Contractor and attendants. The purpose of the preconstruction meeting is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established.
- E. The suggested agenda for the preconstruction meeting would include the following:
  - 1. Distribution and discussion of:
    - a. List of major subcontractors and suppliers.
    - b. Projected schedules.
    - c. Schedule of Values.
  - 2. Critical work sequencing: Relationships and coordination with other contracts and/or work.
  - 3. Major equipment deliveries and priorities.
  - 4. Project coordination: Designation and responsible personnel.

5. Procedures and processing of:
  - a. Field decisions.
  - b. Proposal requests.
  - c. Request for Information.
  - d. Submittals.
  - d. Change Orders.
  - f. Applications for Payment.
6. Submittal of Shop Drawings, project data and samples.
7. Adequacy of distribution of Contract Documents.
8. Procedures for maintaining Record Documents
9. Use of premises:
  - a. Office, work, and storage areas.
  - b. Owner's requirements.
  - c. Access and traffic control.
10. Construction facilities, controls, and construction aids.
11. Temporary utilities.
12. Safety and first aid procedures.
13. Check of required Bond and Insurance certifications.
14. Completion time for contract and liquidated damages.
15. Request for extension of Contract Time.
16. Procedures for periodic monthly (or whatever interval is deemed appropriate or necessary, however, a minimum of monthly meetings will be required) progress meetings, for all involved.
17. Security procedures.
18. Procedures for making partial payments.



19. Guarantees on completed work.
20. Equipment to be used.
21. Project layout and staking of work.
22. Project inspection.
23. Labor requirements.
24. Laboratory testing of material requirements.
25. Provisions for material stored on site and monthly inventory of materials stored.
26. Requirements of other organizations such as utilities, railroads, highway departments, building departments.
27. Rights-of-way and easements.
28. Housekeeping procedures.
29. Liquidated damages.
30. Posting of signs and installation of Project Sign.
31. Pay request submittal dates.
32. Equal opportunity requirements.

#### 1.03 PROGRESS MEETINGS

- A. The Engineer shall schedule regular periodic meetings. The progress meetings will be held a minimum of once per week and at other times as required by the progress of the Work. The first meeting shall be held within thirty (30) days after the preconstruction meeting or thirty (30) days or less after the date of Notice to Proceed, but within 1 week of the commencement of construction.
- B. Hold called meetings as required by progress of the Work.
- C. Location of the meetings: To be determined by Owner/Engineer.
- D. Attendance:
  1. Engineer and his professional Subconsultants as needed.

2. Resident Project Representative.
  3. Contractor and his Superintendent.
  4. Owner's representatives.
  5. Subcontractors (active on the site, as appropriate to the agenda).
  6. Others as appropriate to the agenda (suppliers, manufacturers, other subcontractors, etc.).
- E. The Contractor shall preside at the meetings and provide for keeping minutes and distribution of the minutes to the Owner, Engineer, and others. The purpose of the meetings will be to review the progress of the Work.
- F. The suggested agenda for the progress meetings will include but not be limited to the following:
1. Review approval of minutes of previous meeting.
  2. Review of Work progress since previous meeting and Work scheduled (3-week look ahead schedule).
  3. Field observations, problems, conflicts.
  4. Problems which impede construction schedule.
  5. Review of off-site fabrication, delivery schedules.
  6. Corrective measures and procedures to regain projected schedule.
  7. Status of approved Construction Schedule and revisions to the Construction Schedule as appropriate.
  8. Progress schedule during succeeding work period.
  9. Coordination of schedules.
  10. Review status of submittals and submittal schedule, expedite as required.
  11. Maintenance of quality standards.
  12. Pending changes and substitutions.
  13. Shop drawing problems.
  14. Review proposed changes for:

- a. Effect on Construction Schedule and on completion date.
  - b. Effect on other contracts of the Project.
- 15. Critical/long lead items.
- 16. Other business.
- G. The Contractor is to attend progress meetings and is to study previous meeting minutes and current agenda items, and be prepared to discuss pertinent topics and provide specific information including but not limited to:
  - 1. Status of all submittals and what specifically is being done to expedite them.
  - 2. Status of all activities behind schedule and what specifically will be done to regain the schedule.
  - 3. Status of all material deliveries, latest contact with equipment manufacturer, and specific actions taken to expedite materials.
  - 4. Status of open deficiencies and what is being done to correct the same.
- H. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01340: Shop Drawings, Working Drawings, and Samples.

PART 2- PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

## SECTION 01310

### CONSTRUCTION SCHEDULES

#### PART 1 – GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. Promptly after award of the Contract, prepare and submit to Engineer estimated construction progress schedules for the Work, with subschedules of related activities which are essential to its progress.
- B. Submit revised progress schedules to maintain proposed schedule within 30 days of work in place.

##### 1.02 RELATED REQUIREMENTS

- A. Section 01010: Summary of Work.
- B. Section 01041: Project Coordination.
- C. Section 01200: Project Meetings.
- D. Section 01340: Shop Drawings, Product Data and Samples.

##### 1.03 FORM OF SCHEDULES

- A. Prepare schedules in the form of:
  - 1. Gant Chart.
  - 2. Network Analysis System.
  - 3. Other Method Accepted by Engineer.
- B. Format of Listings: The chronological order of the start of each item of work.

##### 1.04 CONTENT OF SCHEDULES

- A. Construction Progress Schedule:
  - 1. Show the complete sequence of construction by activity.

2. Show the dates for the beginning, and completion of each major element of construction. Specifically list:
  - a. Site work.
  - b. Site utilities.
  - c. Demolition.
  - d. Structural work.
  - e. Subcontractor work.
  - f. Equipment installations.
  - g. Operating and Maintenance Data.
  - h. Start-up.
- B. Submittals, Schedule for Shop Drawings, Product Data and Samples. Show:
  1. The dates for Contractor's submittals.
  2. The dates reviewed submittals will be required from the Engineer.
  3. Provide subschedules to define critical portions of prime schedules.

#### 1.05 PROGRESS REVISIONS

- A. Indicate progress of each activity to date of submission.
- B. Show changes occurring since previous submission of schedule:
  1. Major change in scope.
  2. Activities modified since previous submission.
  3. Revised projections of progress and completion.
  4. Other identifiable changes.
- C. Provide a narrative report as needed to define:
  1. Problem areas, anticipated delays, and the impact on the schedule.
  2. Corrective action recommended, and its effect.
  3. The effect of changes on schedules of other prime contractors.

#### 1.06 SUBMISSIONS

- A. Submit initial schedules within 10 days after the effective date of the Agreement.
  - 1. Engineer will review schedules and return review copy within 10 days after receipt.
  - 2. If required, resubmit within seven days after return of review copy.
- B. With each application for payment, submit progress schedule if revised since last payment request.

#### 1.07 DISTRIBUTION

- A. Distribute copies of the reviewed schedules to:
  - 1. Engineer – Two (2) copies
  - 2. Owner – Two (2) copies
  - 3. Job site file.
  - 4. Subcontractors.
  - 5. Other concerned parties.
- B. Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedules.
- C.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

## SECTION 01340

### SHOP DRAWINGS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. The Contractor shall submit to the Engineer for review and approval, such Shop Drawings, Test Reports and Product Data on materials and equipment (hereinafter in this Section called Data), and material samples (hereinafter in this Section called Samples) as are required for the proper control of work, including but not limited to those Shop Drawings, Data and Samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.
2. Within fourteen (14) calendar days after the Notice to Proceed date, the Contractor shall submit to the Engineer a complete list of preliminary Data on items for which Shop Drawings are to be submitted. Included in this list shall be the names of all proposed manufacturers furnishing specified items. Review of this list by the Engineer shall in no way expressed or implied relieve the Contractor from submitting complete Shop Drawings and providing materials, equipment, etc., fully in accordance with the Specifications. This procedure is required in order to expedite final review of Shop Drawings. The Contractor shall include Shop Drawing review time on the Project schedule (see section 01310).
3. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the Owner and the Engineer. This log should include the following items:
  - a. Submittal-Description and Number assigned.
  - b. Date to Engineer.
  - c. Date returned to Contractor.
  - d. Status of Submittal (Approved as Noted, Rejected/Re-submit).
  - e. Date of Resubmittal and Return (as applicable).
  - f. Date material release for fabrication.
  - g. Projected date of fabrication.
  - h. Projected date of delivery to site.

- i. Status of O&M manuals submittal.
- j. Specification Section.
- k. Drawings Sheet Number.

B. Related Requirements Described Elsewhere:

- 1. General Conditions.
- 2. Progress Schedules: Section 01310.
- 3. Material and Equipment: Section 01600.
- 4. Project Record Documents: Section 01720.

1.02 CONTRACTOR'S RESPONSIBILITY

- A. The Contractor shall furnish the Engineer a schedule of Shop Drawings submittals fixing the respective dates for the submission of Shop Drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.
- B. The Contractor shall not begin any of the work covered by a Shop Drawing, Data, or a Sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the Engineer, with approval.
- C. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than thirty (30) calendar days for checking and appropriate action from the time the Engineer receives them.
- D. All submittals shall be accompanied with a transmittal letter prepared in duplicate containing the following information:
  - 1. Date.
  - 2. Project Title and Number.
  - 3. Contractor's name and address.
  - 4. The number of each Shop Drawings, Project Data, and Sample submitted.



5. Notification of Deviations from Contract Documents.
    - a. The Contractor shall indicate in **bold type** at the top of the cover sheet of submittal of Shop Drawing if there is a deviation from Contract Drawings, Project Specifications and referenced specifications or codes.
    - b. The Contractor shall also list any deviations from Contract Drawings, Project Specifications and referenced specifications or codes and identify in "green" ink prominently on the drawings.
  6. Submittal Log Number conforming to Specification Log Number.
- E. The Contractor shall submit all shop drawings in electronic format. Shop drawings which require the signature and seal of a registered professional shall be submitted in hard copy format. In addition to electronic submittals, the contractor may be required to submit additional hard copies of all submittals upon request from the Owner or the Engineer.
  - F. The Contractor shall be responsible for and bear all costs of damages which may result from the ordering of any material or from proceeding with any part of work prior to the completion of the review by the Engineer of the necessary Shop Drawings.
  - G. The Contractor shall be fully responsible for observing the need for and making any changes in the arrangement of piping equipment, connections, wiring, manner of installation, etc., which may be required by the materials/equipment he proposed to supply both as pertains to his own work and any work affected under other parts, headings, or divisions of drawings and specifications.
  - H. The Contractor shall not use Shop Drawings as means of proposing alternate items to demonstrate compliance to Contract requirements. **Alternate items must be submitted during the bidding process.**
  - I. Each submittal will bear a stamp indicating that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
  - J. Drawings and schedules shall be checked and coordinated with the work of all trades and sub-contractors involved, before they are submitted for review by the Engineer and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.

### 1.03 ENGINEER'S REVIEW OF SHOP DRAWINGS

- A. The Engineer's review of Shop Drawings, Data and Samples as submitted by the Contractor, will be to determine if the items(s) conform to the information in the Contract Documents and are compatible with the design concept. The Engineer's review and exceptions, if any, will not constitute an approval of dimensions, connections, quantities, and details of the material, equipment, device, or item shown.
- B. The review of drawings and schedules will be general, and shall not be construed:
  - 1. As permitting any departure from the Contract requirements.
  - 2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials.
  - 3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.
- C. If the drawings or schedules as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.
- D. "Approved As Noted" - Contractor shall incorporate Engineer's comments into the submittal before release to manufacturer. The Contractor shall send a letter to the Engineer acknowledging the comments and their incorporation into the Shop Drawing.
- E. "Amend And Resubmit" - Contractor shall resubmit the Shop Drawing to the Engineer. The resubmittal shall incorporate the Engineer's comments highlighted on the Shop Drawing.
- F. "Rejected" - Contractor shall resubmit Shop Drawing for review by Engineer.
- G. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.
- H. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.
- I. When the Shop Drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.
- J. No partial submittals will be reviewed. Submittals not deemed complete will be stamped "Rejected" and returned to the Contractor for resubmittal. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items for:

1. Systems.
2. Processes.
3. As indicated in specific Specifications Sections.

All drawings, schematics, manufacturer's product Data, certifications and other Shop Drawing submittals required by a system specification shall be submitted at one time as a package to facilitate interface checking.

K. Only the Engineer shall utilize the color "red" in marking Shop Drawing submittals.

#### 1.04 SHOP DRAWINGS

- A. Shop Drawings shall be complete and detailed and shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer's scale drawings, and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature, and performance and test data, shall be considered only as supportive information. As used herein, the term "manufactured" applies to standard units usually mass-produced; and "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements.
- B. Manufacturer's catalog sheets, brochures, diagrams, illustrations and other standard descriptive data shall be clearly marked to identify pertinent materials, product or models. Delete information which is not applicable to the Work by striking or cross-hatching.
- C. Each Shop Drawing shall have a blank area 3-1/2 inches by 3-1/2 inches, located adjacent to the title block. The title block shall display the following:
  1. Project Title and Number.
  2. Name of Project building or structure.
  3. Number and title of the Shop Drawing.
  4. Date of Shop Drawing or revision.
  5. Name of contractor and subcontractor submitting drawing.
  6. Supplier/manufacturer.
  7. Separate details when pertinent.
  8. Specification title and number.
  9. Specification section.

10. Application Contract Drawing Number.

- D. Data on materials and equipment include, without limitation, materials and equipment lists, catalog data sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent Data.
- E. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

1.05 WORKING DRAWINGS

- A. When used in the Contract Documents, the term "Working Drawings" shall be considered to mean the Contractor's plan for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, ground water control systems, forming and falsework; for underpinning; and for such other work as may be required for construction but does not become an integral part of the Project.
- B. Working Drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida.

1.06 SAMPLES

- A. The Contractor shall furnish, for the approval of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until approved by the Engineer.
- B. Samples shall be of sufficient size and quantity to clearly illustrate:
  - 1. Functional characteristics of the product, with integrally related parts and attachment devices.
  - 2. Full range of color, texture and pattern.
  - 3. A minimum of two (2) samples of each item shall be submitted.
- C. Each sample shall have a label indicating:
  - 1. Name of Project.
  - 2. Name of Contractor and Subcontractor.
  - 3. Material or Equipment Represented.

4. Place of Origin.
5. Name of Producer and Brand (if any).
6. Location in Project.

Samples of finished materials shall have additional marking that will identify them under the finished schedules.

- D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required in Paragraph 1.06B. above. He shall enclose a copy of this letter with the shipment and send a copy of this letter to the Engineer. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.
- E. Approved samples not destroyed in testing shall be sent to the Engineer or stored at the site of the Work. Approved Samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment incorporated in work shall match the approved Samples. Samples which failed testing or were not approved will be returned to the Contractor at his expense, if so requested at time of submission.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01370  
SCHEDULE OF VALUES

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

- A. As the first shop drawing submittal, submit to the Engineer a Schedule of Values allocated to the various portions of the Work, within ten days after award of contract.
- B. Upon the request of the Engineer, support the values with data which will substantiate their correctness.
- C. The Schedule of Values, unless objected to by the Engineer, shall be exclusively used as the basis for the Contractor's Applications for Payment.

1.02 RELATED REQUIREMENTS

- A. Section 01152: Application for Payment.
- B. Section 01600: Material and Equipment.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Type schedule on 8-1/2 inch x 11-inch white paper; Contractor's standard forms and automated printout will be considered for approval by Engineer upon Contractors request. Identify schedule with:
  - 1. Title of Project, location and (City, County, Owner) Project Number.
  - 2. Engineer and Engineer's Project Number.
  - 3. Name and Address of Contractor.
  - 4. Date of Submission.
- B. Schedule shall list the installed value of the component parts of the Work, in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. Follow the table of contents of these Specifications as the format for listing component items.
  - 1. Identify each line item with the number and title of the respective major section of the specifications.
- D. For each major line item list sub-values of:

1. Major products or operations under the item.
  2. Contract conditions, such as: bonds, insurance premiums, job mobilization, construction facilities and temporary controls.
- E. For the various portions of the Work:
1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
  2. For items on which progress payments will be requested for stored materials, break down the value into:
    - a. The cost of the materials, delivered and unloaded, with taxes paid.
    - b. The total installed value.
- F. The sum of all values listed in the schedule shall equal the total Contract Sum.

#### 1.04 SUBSCHEDULE OF UNIT MATERIAL VALUES

- A. Submit a subschedule of unit costs and quantities for:
1. Products specified under a unit cost.
  2. Products on which progress payments will be requested for stored products.
- B. The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
- C. The unit quantity for bulk materials shall include an allowance for normal waste.
- D. The unit values for the materials shall be broken down into:
1. Cost of the material, delivered and unloaded at the site, with taxes paid.
  2. Installation costs, including Contractor's overhead and profit.
- E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the schedule of Values.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

## SECTION 01390

### PRE-CONSTRUCTION AUDIO-VIDEO RECORD

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Scope of Work: Prior to commencing work, the Contractor shall have a continuous color audio-video DVD or USB recording taken along the entire length of the Project (inside the building and outside) and at all proposed construction sites within the Project area to serve as a record of pre-construction conditions.

##### 1.02 QUALITY ASSURANCE

- A. The Contractor shall engage the services of a professional videographer. The color audio-video DVDs or USBs shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business or preconstruction color audio-video DVD or USB documentation.
- B. The videographer shall furnish to the Engineer a list of all equipment to be used for the audio-video taping, i.e., manufacturer's name, model number, specifications and other pertinent information.
- C. Additional information to be furnished by the videographer is the names and addresses of two references that the videographer has performed color audio-video taping for, on projects of a similar nature, within the last 12 months.
- D. Owner's Representative must be present during filming. Provide Owner five (5) days notice prior to start of filming.
- E. No construction shall begin prior to review and approval of the DVD OR USBs covering the construction area by the Owner and Engineer. The Engineer shall have the authority to reject all or any portion of a video DVD OR USB not conforming to specifications and order that it be redone at no additional charge.
- F. The Contractor shall reschedule unacceptable coverage within five (5) days after being notified. The Engineer shall designate those areas, if any, to be omitted from or added to the audio-video coverage.
- G. DVD OR USB recordings shall not be made more than ninety (90) days prior to construction in any area. All DVD OR USBs and written records shall become property of Owner.

#### PART 2 - PRODUCTS

##### 2.01 AUDIO-VIDEO DVD OR USBs

- A. Audio-video DVD OR USBs shall be new. Reprocessed DVD OR USBs will not be acceptable.



## PART 3 - EXECUTION

### 3.01 EQUIPMENT

- A. All equipment, accessories, materials and labor to perform this service shall be furnished by the Contractor.
- B. The total audio-video system shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of imperfection. The audio portion of the recording shall reproduce the commentary of the camera operator with proper volume, clarity and be free from distortion and interruptions.
- C. When conventional wheeled vehicles are used, the distance from the camera lens to the ground shall not be more than ten (10) feet. In some instances, audio-video DVD OR USB coverage may be required in areas not accessible by conventional wheeled vehicles. Such coverage shall be obtained by walking or special conveyance provided by the Contractor.
- D. The color video camera used in the recording system shall have a horizontal resolution of 350 lines at center, a luminance signal to noise ratio of 45 dB and a minimum illumination requirement of one (1) foot candle.

### 3.02 RECORDED INFORMATION - AUDIO

- A. Each DVD OR USB shall begin with the current date, project name and municipality 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 the narrative commentary of the videographer, recorded simultaneously with his fixed elevation video record of the zone of influence of construction.
- B. The Owner and Engineer reserves the right to supplement the audio portion of the taping as deemed necessary. A representative of the Owner or Engineer shall be selected to provide such narrative.

### 3.03 RECORDED INFORMATION - VIDEO

- A. All video recordings shall, by electronic means, display on the screen the time of day, the month, day and year of the recording. This time and date information must be continuously and simultaneously generated with the actual recording.
- B. Each video DVD OR USB shall have a log of that video DVD OR USB's contents. The log shall describe the various segments of coverage contained on that video DVD OR USB in terms of the names of streets or easements, coverage beginning and end, directions of coverage, video unit counter numbers, engineering stationing numbers and the date.

### 3.04 LIGHTING

- A. All audio-video shall be done during time of good visibility. No recording shall be done during precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.

### 3.05 AREA OF COVERAGE

- A. Coverage shall include all surface features located within the zone of influence of construction supported by appropriate audio coverage. Such coverage shall include, but not be limited to, existing driveways, sidewalks, curbs, pavements, ditches, mailboxes, landscaping, culverts, fences, signs, and headwalls within the area covered.

END OF SECTION

## SECTION 01400

### QUALITY CONTROL

#### PART 1 -- GENERAL

##### 1.1 DEFINITION

- A. Specific quality control requirements for the Work are indicated throughout the Specifications and Drawings. The requirements of this Section are primarily related to performance of the Work beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements performed by the Contractor. Quality Assurance refers to similar inspection and testing performed by the Owner to verify the quality control process.

##### 1.2 SAMPLING AND TESTING

- A. Unless otherwise indicated, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered.
- B. The Owner reserves the right to make independent investigations and tests, and failure of any portion of the Work to meet any of the requirements of the Drawings or Specification, shall be reasonable cause for the Owner to require the removal or correction and reconstruction of any such work in accordance with the Contract Agreement.

##### 1.3 INSPECTION AND TESTING LABORATORY SERVICE

- A. Inspection and testing laboratory service shall comply with the following:
  - 1. Owner may appoint, employ, and pay for services of an Independent Testing Laboratory to perform inspection and testing or will perform inspection and testing itself as a part of the Quality Assurance testing program.
  - 2. The Owner or the Independent Testing Laboratory may, at the Owner's direction, perform inspections, testing, and other services specified in individual specification sections, even though the specification section specifically requires that the Contractor perform the test. This does not relieve the Contractor from their testing requirements.
  - 3. Reports from the testing laboratory will be provided to the Owner in support of NON-COMPLIANCE NOTICES (NCN).
  - 4. All quality control data, test results and records will be submitted to the Owner as a part of the Project Closeout.

#### 1.4 CONTRACTOR SUBMITTALS

- A. Contractor shall submit a Quality Control Plan. Submittals shall be in accordance with Section 01300 – Contractor Submittals.

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

#### PART 3 -- EXECUTION

- 3.1. Inspection: The Contractor shall inspect materials or equipment upon the arrival on the job site and immediately prior to installation and reject damaged and defective items.
- 3.2. Measurements: The Contractor shall verify measurements and dimensions of the Work as an integral step of starting each installation.
- 3.3. Manufacturer's Instructions: Where installations include manufactured products, the Contractor shall comply with manufacturer's applicable instructions and recommendations for installation to whatever extent these are more explicit or more stringent than applicable requirements indicated in Drawings and Specifications.
- 3.4 Specialist Support: QA/QC Testing provided by Contractor is as follows:
  - A. Miscellaneous QA/QC testing not specified below as ordered by Owner.
  - B. Backfill Compaction Tests: Density tests at random intervals above pipe shall confirm compaction to the specified density as indicated in the Drawings. One compaction test location shall be required for each 300 linear feet of pipe and for every 100 square feet of backfill around tie-ins, fire hydrants, etc. as a minimum. A minimum of one potable water line compaction test will occur between the beginning of and ending of the line segment. The locations of the compaction tests within the trench shall be in conformance with the following schedule:
    - 1. One test at the spring line of the pipe unless bedding material is provided to the spring line
    - 2. One test at an elevation of one foot above the top of the pipe
    - 3. One test for each 2 feet of backfill placed from one foot above the top of the pipe to finished grade elevation
    - 4. At least two test locations are required for each trench crossing existing pavement.
    - 5. One test for each 100 SF of filled area every 2 feet of backfill placed at tie-ins, fire hydrants, etc. from two feet above the tie-in, fire hydrant, etc. to finished grade.
  - C. LBR / Moisture: Limerock Bearing Ratio and moisture/density relationship reports to be conducted on samples, as required for FDOT, to establish proctor and LBRs.

- D. Roadway Subgrade: Density tests within stabilized subgrade to confirm 98% compaction achieved for 4-lane roads and for local roads (98% when proofrolled). Tests to occur at approximately 300ft intervals with a minimum of at least one test per road crossing.
- E. Roadway Base: Density tests within the base to confirm 98% compaction achieved. Tests to occur at approximately 300ft intervals with a minimum of at least one test per road crossing.
- F. Asphaltic Concrete: Asphalt extractions to confirm conformance to asphalt concrete mix design.
- G. Asphaltic Concrete: Pavement thickness and density testing to be conducted as required to confirm specified paving thickness and compaction has been achieved.
- H. Asphaltic Concrete: Contractor shall utilize an appropriately sized screed for all asphalt paving.
- I. Concrete Testing: Concrete compressive strength testing to be conducted at random driveway and sidewalk concrete or other placed concrete, as required by Owner.
- J. Non-conformities to be identified to Contractor by Owner in writing.
- K. Unsuitable fill and over excavation limits

### 3.5 CONTRACTOR QA/QC TESTING

Contractor shall provide any QA/QC testing not outlined in Paragraph 3.4 above as necessary to complete the Work in accordance with the Contract Documents.

END OF SECTION

## SECTION 01500

### CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

#### PART 1 – GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. Furnish, install and maintain temporary utilities required for construction, remove on completion of Work.

##### 1.02 RELATED REQUIREMENTS

- A. Section 01010: Summary of Work.

##### 1.03 REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with National Electric Code.
- B. Comply with Federal, State and local codes and regulations and with utility company requirements.

#### PART 2 – PRODUCTS

##### 2.01 MATERIALS, GENERAL

- A. Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

##### 2.02 TEMPORARY ELECTRICITY AND LIGHTING

- A. Arrange with utility company, provide service required for power and lighting, and pay all costs for service and for power use.
- B. Install circuit and branch wiring, with area distribution boxes located so that power and lighting is available throughout the construction by the use of construction-type power cords.
- C. Provide adequate artificial lighting for all areas of work when natural light is not adequate for work, and for areas accessible to the public.

##### 2.03 TEMPORARY HEAT AND VENTILATION

- A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the

installation of materials, and to protect materials and finishes from damage due to temperature or humidity.

- B. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.
- C. Portable heaters shall be standard approved units complete with controls.
- D. Pay all costs of installation, maintenance, operation and removal, and for fuel consumed.

#### 2.04 TEMPORARY WATER

- A. Contractor shall obtain a backflow preventer and meter from the Owner prior to use.
- B. Make conservative use of water. Any negligence or wastefulness will be reason for waiving the provisions for free water.
- C. All connections to hydrants to be made by Owner's personnel.
- D. Water utilization for concrete plaster and mortar shall meet the respective requirements and standards set forth for water utilized in these construction materials.
- E. The Owner will make water available at designated hydrants on the Owner's water system for use by the Contractor.

#### 2.05 TEMPORARY SANITARY FACILITIES

- A. Provide sanitary facilities in compliance with laws and regulations.
- B. Service, clean and maintain facilities and enclosures.

#### 2.06 TEMPORARY ACCESS ROAD AND PARKING (NOT USED)

#### 2.07 TEMPORARY CONTROLS

- A. Dust Control:
  - 1. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and provide positive means to prevent air-borne dust from dispersing into the atmosphere.
- C. Debris Control:
  - 1. Maintain all areas under Contractor's control free of extraneous debris.
  - 2. Initiate and maintain a specific program to prevent accumulation of debris at construction site, storage and parking areas, or along access roads and haul routes.
    - a. Provide acceptable containers for deposit of debris.

- b. Prohibit overloading of trucks to prevent spillages on access and haul routes.
    - 1) Provide periodic inspection of traffic areas to enforce requirements.
- 3. Schedule periodic collection and disposal of debris.
  - a. Provide additional collections and disposals of debris whenever the periodic schedule is inadequate to prevent accumulation.
- D. Pollution Control:
  - 4. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations.
  - 5. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.
    - a. Excavate and dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.
  - 6. Take special measure to prevent harmful substances from entering public waters.
    - a. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.
  - 7. Provide systems for control of atmospheric pollutants.
    - a. Prevent toxic concentrations of chemicals.
    - b. Prevent harmful dispersal of pollutants into the atmosphere.

## PART 3 – EXECUTION

### 3.01 GENERAL

- A. Comply with applicable requirements specified in Division 15 – Mechanical, and in Division 16 – Electrical.
- B. Maintain and operate systems to assure continuous service.
- C. Modify and extend systems as work progress requires.

### 3.02 REMOVAL

- A. Completely remove temporary materials and equipment when their use is no longer required.
- B. Clean and repair damage caused by temporary installations or use of temporary facilities.
- C. Restore permanent facilities used for temporary services to specified condition.



END OF SECTION

## SECTION 01505

### MOBILIZATION

#### PART 1 -- GENERAL

##### 1.1 GENERAL

- A. Mobilization shall include the obtaining of all permits; moving onto the site of all necessary equipment; furnishing and erecting temporary buildings and other construction facilities; and implementing security requirements; all as required for the proper performance and completion of the Work. Mobilization shall include the following principal items:
1. Mobilize to the site of all Contractor's equipment, personnel, supplies, and incidentals required for first month's operations.
  2. Project sign in accordance with Section 01580, if required.
  3. On-site sanitary facilities, safety equipment, and first aid supplies.
  4. Arrange for Work and storage yard in accordance with Section 01550.
  5. Mobilize full-time superintendent to the job site.
  6. Detailed approved schedule in accordance with Section 01310.
  7. Required submittals which allow the Contractor to commence Work.
  8. All required permits, insurance, bonds and licenses to commence Work.
  8. Post all OSHA, MSDS, SRF and NPDES required notices.
  9. Safety Plan.

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

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

END OF SECTION

## SECTION 01530

### PROTECTION OF EXISTING FACILITIES

#### PART 1 – GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. Where applicable furnish, install and maintain suitable barriers as required to prevent public entry, and to protect the Work, existing facilities, trees and plants from construction operations; remove when no longer needed, or at completion of Work.

##### 1.02 RELATED REQUIREMENTS

- A. Section 01010: Summary of Work.
- B. Section 01500: Construction Facilities and Temporary Controls.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS, GENERAL

- A. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

##### 2.02 FENCING

- A. Minimum fence height six feet.
- B. Open-Mesh Fence:
  - 1. Galvanized steel posts; 1-1/2 inch line posts and two inch corner posts.

##### 2.03 BARRIERS

- A. Materials are Contractor's option, as appropriate to serve required purpose.

#### PART 3 – EXECUTION

##### 3.01 GENERAL

- A. Install facilities of a neat and reasonably uniform appearance, structurally adequate for the required purposes.
- B. Maintain barriers during entire construction period.
- C. Relocate barriers as required by the progress of construction.

##### 3.02 FENCES

- A. Provide and maintain fences necessary to assure security of the site during construction to keep unauthorized people and animals from the site when construction is not in progress.
- B. Gates shall have locks; and keys shall be furnished to the Owner.
- C. Provide additional security measures as deemed necessary and approved by the Engineer.

### 3.03 TREE AND PLANT PROTECTION

- A. Preserve and protect existing trees and plants at site which are designated to remain, and those adjacent to site.
- B. Consult with the Engineer, and remove agreed-on roots and branches which interfere with construction.
  - 1. Employ qualified tree surgeon to remove branches and treat cuts.
- C. Provide temporary barriers to a height of six feet, around each, or around each group, of trees and plants.
- D. Protect root zones of trees and plants:
  - 1. Do not allow vehicular traffic or parking.
  - 2. Do not store materials or products.
  - 3. Prevent dumping of refuse or chemically injurious materials or liquids.
  - 4. Prevent puddling or continuous running water.
- E. Carefully supervise excavating, grading and filling, and other construction operations, to prevent damage.
- F. Replace, or suitably repair, trees and plants designated to remain which are damaged or destroyed due to construction operations.

### 3.04 REMOVAL

- A. Completely remove barricades, when construction has progressed to the point that they are no longer needed and when approved by Engineer.

END OF SECTION

## SECTION 01540

### HURRICANE PREPAREDNESS

#### PART 1 -- GENERAL

##### 1.1 THE REQUIREMENT

- A. The Contractor is responsible for having plans for protection of the WORK site during hurricanes, and shall prepare and submit a Hurricane Preparedness Plan prior to any construction activity and mobilization.
- B. The Hurricane Preparedness Plan shall be submitted to the Owner at the Preconstruction Meeting for approval and shall include the following:
  - 1. Items and equipment that must be removed from the WORK site.
  - 2. Methods and materials that will be utilized to secure the materials and WORK site.
  - 3. Methods and materials that will be utilized to protect uncompleted WORK items.
  - 4. Plan for maximizing traffic lanes for evacuation.
  - 5. Items that must commence at the time of hurricane watch in order to be completed prior to evacuation.
- C. When the National Weather Service issues a Hurricane Watch for Lee, Charlotte, or Collier County, the Contractor shall immediately implement the Hurricane Preparedness Plan.
- D. The cost of preparing and implementing the Hurricane Preparedness Plan shall be the responsibility of the Contractor. Hurricane watch and warning will be grounds for contract time extensions.
- E. When the National Weather Service issues a Hurricane Warning for Lee, Charlotte, or Collier County, the Contractor shall immediately take down and securely store all project signs. Signs shall be restored to the site prior to commencing construction activities.
- F. The Contractor shall notify the Owner upon activation of the hurricane preparedness plan, when preparations are complete, when the job site is secure, and when the job site is shut down.

##### 1.2 CONTRACTOR SUBMITTALS

- A. Submittals of the Hurricane Preparedness Plan shall be in accordance with Section 01340 Shop Drawings.

PART 2 — PRODUCTS (NOT USED)

PART 3 — EXECUTION (NOT USED)

END OF SECTION

## SECTION 01550

### SITE ACCESS AND STORAGE

#### PART 1 -- GENERAL

##### 1.1 HIGHWAY LIMITATIONS

- A. The Contractor shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the Work. It shall be the Contractor's responsibility to construct and maintain any haul roads required for its construction operations and repair any damage to public and private roads caused by the Contractor's construction operations.

##### 1.2 TEMPORARY CROSSINGS

- A. General: Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, hospitals and any other public facilities. Safe and adequate public transportation stops and pedestrian crossings on major roadways shall be maintained as determined by Owner. The Contractor shall cooperate with parties involved in the delivery of mail and removal of trash and garbage so as to maintain existing schedules for such services. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time.
- B. Temporary Bridges: Wherever necessary, the Contractor shall provide suitable temporary bridges or steel plates over unfilled excavations. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case, and the Contractor shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.
- C. Street Use: Nothing herein shall be construed to entitle the Contractor to the exclusive use of any public street, alleyway, or parking area during the performance of the Work hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No roadway shall be closed to the public using type III barricades and signage without first obtaining permission of the Owner. Permission must be obtained two (2) weeks prior to closure. Where excavation is being performed in 4-lane roads or highways, one lane in each direction shall be kept open to traffic at all times except in extreme cases when approved by the Owner. Toe boards shall be provided to retain excavated material if required by the Owner or the agency having jurisdiction over the street or highway. Operating fire hydrants on or adjacent to the Work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the Contractor to assure the use of sidewalks (unless posted with Sidewalk Closed signage) and the proper functioning of all gutters, storm drain inlets, and other drainage facilities.

- D. Temporary Street Closure: If closure of any street is required during construction, the Contractor shall submit such requests in writing to the Owner. When the closure of a 4-lane road is allowed by the Owner, a request must be submitted at least (4) weeks in advance of the required closure in order to coordinate with the Owner and any other jurisdictional agency. The traffic control plan indicating detours and emergency access to cul-de-sacs shall accompany any request. The Contractor shall provide placards reading "Road Closed Local Traffic Only" during the closure of any street.
- E. Temporary Mailbox Cluster(s): The Contractor shall provide temporary mailbox clusters where the permanent mailboxes are not accessible for delivery due to construction.

### 1.3 TEMPORARY SOIL TRACKING PROTECTION MEASURES

- A. General: The Contractor shall provide temporary soil tracking protection measures at the entrance to central storage areas that affect paved roads. The temporary protection measures shall be in accordance with the 'Florida Erosion and Sediment Control Inspectors Manual.' Proposed details for the temporary construction entrance are shown in the contract drawings.
- B. Temporary Soil Tracking Protection Measures shall be constructed with FDOT No. 1 Coarse aggregate (1.5 - 3.5 in. stone) as indicated in FDOT Standard Specifications for Road and Bridge Construction. The thickness of the aggregate layer shall be a minimum of 6 inches and shall cover the full width of the vehicular ingress/egress area. The entrance shall be a minimum of 50 feet and accommodate a turning radius for large trucks. The temporary Soil Tracking Protection Measures shall follow the contour of the natural terrain. Slopes shall not exceed 10 percent. The road shall be stabilized with 2-inch stone to reduce erosion and degradation of the temporary roadbed.
- C. The area for the temporary Soil Tracking Protection Measures shall be cleared of all vegetation, roots and other unsuitable material. A geotextile shall be laid directly underneath the gravel layer.
- D. Soil Tracking Protection Measures shall be maintained in a condition which prevents tracks or flow of mud into the public right of way. The Contractor shall be responsible for the maintenance of Soil Tracking Protection Measures during the construction period.

### 1.4 CONTRACTOR'S WORK AND STORAGE AREAS

- A. The Contractor shall make its own arrangements for all temporary storage, shop, or field office areas necessary for the proper execution of the Work and shall obtain prior written permission from any owner whose property is used for such purposes.
- B. The Contractor's temporary areas shall be kept in a clean and orderly fashion at all times. The areas will be sloped to drain off all storm runoff. The entrance to the storage areas shall be constructed in accordance with the drawings with a drainage pipe to protect the swale and an entrance driveway of 6 inches of crushed stone road base laid on suitable geotextile (filter fabric). Sediment control traps shall be positioned so as to ensure that downstream catch basins and drains are protected from runoff containing silt from the temporary areas. A sedimentation trap can be constructed by either excavating below grade or building an embankment across a swale



and an open-channel spillway provided. Silt fence shall be provided around all central storage areas, limerock and central soil stockpiles.

Storage of materials and equipment on corners, intersections, or turn lanes shall not obstruct line of sight in intersection and shall be at least 6 feet off of the edge of pavement. All central storage sites shall be posted with "No Trespassing" signs every 100 feet around the site.

- C. The Contractor shall construct and use a separate storage area for hazardous materials used in constructing the Work and shall obtain written permission from any owner whose property is used for storage or shop areas.
  - 1. For the purpose of this paragraph, hazardous materials to be stored in the separate area are defined as all products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, Flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, two-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.
  - 2. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.
  - 3. The Contractor shall develop and provide to the Owner a plan for storing and disposing of the materials above.
  - 4. The separate storage area shall meet all the requirements of all authorities having jurisdiction over the storage of hazardous materials. Such authorities include the Florida Department of Environmental Protection.
  - 5. All hazardous materials that are delivered in containers shall be stored in the original containers until use. Hazardous materials that are delivered in bulk shall be stored in containers that meet the requirements of authorities having jurisdiction.
- D. The Contractor shall maintain the storage area while it is in use and restore it to its original condition at the completion of the Project. Restoration shall include removal of temporary culverts and driveways and establishing grass by seeding or sodding disturbed construction and storage areas. All areas must be completely restored and have an established stand of grass in accordance with Section 02822 – Solid Sodding. Downstream sediment traps shall be removed once the restoration is complete and the grass has stabilized the area from significant erosion.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION (Not Used)

END OF SECTION

## SECTION 01600

### MATERIAL AND EQUIPMENT

#### PART 1 – GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. Products.
- B. Workmanship.
- C. Manufacturer's Instructions.
- D. Transportation and Handling.
- E. Storage and Protection.

##### 1.02 RELATED REQUIREMENTS

- A. Section 01010: Summary of Work.
- B. Section 01090: Reference Standards.
- C. Section 01340: Shop Drawings.
- D. Section 01700: Contract Closeout.

##### 1.03 PRODUCTS

- A. Products include material, equipment, and systems.
- B. Comply with Specifications and referenced standards as minimum requirements.
- C. Components required to be supplied in quantity within a Specification section shall be the same, and shall be interchangeable.

##### 1.04 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship for specified quality.
- C. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

#### 1.05 MANUFACTURER'S INSTRUCTIONS

- A. When work is specified to comply with manufacturer's instructions, submit copies as specified in Section 01340, and distribute copies to persons involved, and maintain one set in field.
- B. Perform work in accordance with details of instructions and specified requirements. Should a conflict exist between Specifications and instructions, consult with the Engineer.

#### 1.06 TRANSPORTATION AND HANDLING

- A. Provide equipment and personnel necessary to handle products, including those provided by Owner, by methods to prevent soiling or damage to products or packaging.
- B. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.
- C. Handle products by methods to prevent bending or overstressing.
- D. Lift heavy components only at designated lifting points.

#### 1.07 STORAGE AND PROTECTION

- A. Store Products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive Products in weather-tight enclosures and maintain within temperature and humidity ranges required by manufacturer's instructions.
- B. For exterior storage of fabricated Products, place on supports above ground. Cover Products subject to deterioration with impervious sheet covering; and provide ventilation to avoid condensation.
- C. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- D. Arrange storage to provide access for inspection. Periodically inspect to assure Products are undamaged, and are maintained under required conditions.
- E. After installation, provide coverings to protect Products from damage from traffic and construction operations. Remove when no longer needed.
- F. During such periods of time that are designated by the United States Weather Bureau as being a hurricane warning or alert, construction materials or equipment shall be secured against displacement by wind and storm surge forces.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

## SECTION 01650

### STARTING OF MECHANICAL SYSTEMS

#### PART 1 – GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. Provide material and labor required to perform start-up of each respective item of equipment and system. Startup shall include adjustment and balance procedures.
  - 1. Provide information and assistance required, cooperate with test, adjust and balance services.
- B. Comply strictly with specified procedures in starting up mechanical systems.
- C. Contractor to provide assistance, as required during startup. Contractor will obtain services of Factory Service Representative for actual startup.

##### 1.02 RELATED REQUIREMENTS

- A. Section 01041: Project Coordination.
- B. Each Specification Section as Applicable.

##### 1.03 START-UP PROCEDURES

- A. Motors:
  - 1. Check each motor for amperage comparison to nameplate value.
  - 2. Correct conditions which produce excessive current flow, and which exist due to equipment malfunction.
- B. Pumps:
  - 1. Check mechanical seals for cleanliness and adjustment before running pump.
  - 2. Inspect shaft sleeves for scoring.
  - 3. Inspect mechanical faces, chambers, and seal rings, replace if defective.
  - 4. Verify that piping system is free of dirt and scale before circulating liquid through the pump.
- C. Tighten flanges after system has been placed in operation.
  - 1. Replace flange gaskets which show any sign of leakage after tightening.

- D. Inspect screwed joints for leakage.
  - 1. Promptly remake each joint which appears to be faulty, do not wait for rust to form.
  - 2. Clean threads on both parts, apply compound and remake joints.
- E. After system has been placed in operation, clean strainers, dirt pockets, orifices, valve seats and headers in fluid systems, to assure being free of foreign materials.
- F. Check each electrical control circuit to assure that operation complies with specifications and requirements to provide desired performance.
- G. Inspect each pressure gauge for calibration.
  - 1. Replace items which are defaced, broken, or which read incorrectly.
- H. Repair damaged insulation.
- I. Check piping for leaks at every joint, and at every screwed, flanged, or welded connection, using "Leak-Tek" or other approved compound.

#### 1.04 ADJUSTMENTS (NOT USED)

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 – EXECUTION

##### 3.01 HIGH SERVICE PUMP INSTALLATION

- A. Installation shall be in strict accordance with the Manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the Manufacturer's recommendations. Anchor bolts shall be set in accordance with the Manufacturer's recommendations.
- B. The Contractor shall submit a certificate from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

##### 3.02 INSPECTION AND TESTING

- A. General
  - 1. Submit to the Engineer and Owner completed checkout forms and certification of completed demonstration and training forms. Start-up and commissioning shall not begin until all required forms are complete, and all manufacturer's exceptions have been resolved by the Contractor.

2. 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 plant 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. At least two (2) days shall be allocated solely to the instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled at least ten days in advance with the Owner and shall take place prior to plant start-up and acceptance by the Owner. The final copies of operation and maintenance manuals specified in Division 1 must have been delivered to the Engineer prior to scheduling the instruction period with the Owner.
3. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

B. Pumps

1. After all pumps have been completely installed, and working under the direction of the Manufacturer, conduct in the presence of the Engineer, such tests as are necessary to indicate that the pumping system operates satisfactorily and generally meets the conditions of service specified. The factory witnessed tests are the basis of equipment efficiency demonstration, the field test shall demonstrate correct mechanical operation after pump start-up. Field tests shall include all pumps included under this section. Supply all labor, equipment and incidentals required to complete the field tests.
2. If the pump performance does not meet the Specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps which satisfy the conditions specified. A 24-hour operating period of the pumps will be required before acceptance.

C. Motors

1. The Contractor shall megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.
2. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication in accordance with Manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

3.03 START-UP AND INSTRUCTION

- A. Manufacturer's Representative: Present at site or classroom designated by Owner, for

minimum person-days listed below, travel time excluded:

1. Two (2) person-days for installation assistance and inspection.
  2. One (1) person-day for functional and performance testing and completion of Manufacturer's Certificate or Proper Installation and one (1) person-day for pre- startup classroom or site training.
- B. The Contractor shall disinfect the pump and all suction piping and discharge piping in accordance with FDEP regulations.

END OF SECTION



## SECTION 01700

### CONTRACT CLOSEOUT

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Scope of Work: Comply with requirement stated in Conditions of the Contract and in specifications for administrative procedures in closing out the Work.
- B. Related Requirements Described Elsewhere:
  - 1. Cleaning: Section 01710
  - 2. Project Record Documents: Section 01720
  - 3. Warranties and Bonds: Section 01740.

##### 1.02 SUBSTANTIAL COMPLETION

- A. The Work will not be substantially complete, and Contractor may not request substantial completion inspection unless the following submittals and work is completed:
  - 1. All Operation and Maintenance manuals have been submitted and approved.
  - 2. All start-up and demonstration testing completed and Certificates of Completed Demonstration submitted.
  - 3. Project Record Documents have been submitted and reviewed to the requirements of Section 01720.
  - 4. All training of Owner's personnel completed.
  - 5. All areas to be used and occupied are safe, operable in automatic and complete.
  - 6. All deficiencies noted on inspection reports or nonconformances are corrected or the correction plan approved.
- B. When the conditions of paragraph 1.02 A. are met the Contractor shall submit to the Engineer:
  - 1. A written notice that he considers the Work, or portion thereof, is substantially complete, and requests an inspection.
  - 2. A punchlist of items to be corrected with a completion schedule.
- C. Within a reasonable time after receipt of such notice, the Engineer will make an inspection to determine the status of completion.

- D. Should the Engineer determine that the Work is not substantially complete:
  - 1. The Engineer will promptly notify the Contractor in writing, giving the reasons therefor.
  - 2. Contractor shall remedy the deficiencies in the Work and send another written notice of substantial completion to the Engineer.
- E. When the Engineer finds that the Work is substantially complete, he will:
  - 1. Schedule a walk-through of the facility to include the Owner, Engineer to determine the completeness of the punchlist and readiness of the facility for occupancy.
  - 2. Prepare and deliver to Owner a tentative Certificate of Substantial Completion with the tentative punchlist of items to be completed or corrected before final inspection.
  - 3. After consideration of any objections made by the Owner, and when the Engineer considers the Work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected. Any incomplete work allowed on a punchlist must be reinspected upon completion and any deficiencies found will be added to the punchlist.

#### 1.03 FINAL INSPECTION

- A. Prior to Contractors request for a final inspection the following submittals and work must be complete:
  - 1. Project Record Documents must be approved.
  - 2. All spare parts must be suitably delivered.
  - 3. Contractor to submit evidence of compliance with requirements of governing authorities.
- B. After satisfying the requirements of paragraph 1.03 A. and when Contractor considers the Work complete, he shall submit written certification that:
  - 1. Contract Documents have been reviewed.
  - 2. Work has been inspected for compliance with Contract Documents.
  - 3. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
  - 4. All punchlist items have been corrected.

- C. The Engineer will, within reasonable time, make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- D. Should the Engineer consider that the Work is incomplete or defective:
  - 1. The Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
  - 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send another written certification to the Engineer that the Work is complete.
  - 3. The Engineer will, within a reasonable amount of time, reinspect the Work and the Contractor shall be liable for reinspection fees as described in paragraph 1.04, herein.
- E. When the Engineer finds that the Work is acceptable under the Contract Documents, the Contractor may make closeout submittals.

#### 1.04 REINSPECTION FEES

- A. Should the Engineer perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
  - 1. Contractor will compensate the Owner for such additional services.
  - 2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

#### 1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS

- A. Warranties and Bonds: To requirements of Section 01740.
- B. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.
- C. Certificate of Insurance for Products and Completed Operations.

#### 1.06 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a final statement of accounting to the Engineer.
- B. Statement shall reflect all adjustments to the Contract Sum:
  - 1. The original Contract Sum.
  - 2. Additions and deductions resulting from:
    - a. Previous change orders or written amendment.

- b. Allowances.
  - c. Unit prices.
  - d. Deductions for uncorrected work.
  - e. Deductions for liquidated damages.
  - f. Other adjustments.
- 3. Total Contract Sum, as adjusted.
  - 4. Previous payments.
  - 5. Sum remaining due.
- C. Engineer will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.07 FINAL APPLICATION FOR PAYMENT

- A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

## SECTION 01710

### CLEANING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Scope of Work: Execute cleaning, during progress of the Work and at completion of the Work.

##### 1.02 DISPOSAL REQUIREMENTS

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

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

#### PART 3 - EXECUTION

##### 3.01 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 or personal activities.
- B. Provide on-site containers for the collection of waste materials, debris and rubbish.
- C. Remove waste materials, debris and rubbish from the site as needed and dispose of at legal disposal areas away from the site.

### 3.02 DUST CONTROL

- A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until paint is finished.
- B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

### 3.03 FINAL CLEANING

- A. Employ skilled workmen for final cleaning.
- B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.
- C. Prior to final completion, or Owner occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas, to verify that the entire Work is clean.

END OF SECTION

## SECTION 01720

### PROJECT RECORD DOCUMENTS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

A. Scope of Work: Maintain, for the Engineer, one (1) record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications of the Contract.
5. Engineer's Field Orders or written instructions.
6. Approved Shop Drawings, Working Drawings and Samples.
7. Field Test records.
8. Construction photographs.

B. Related Requirements Described Elsewhere:

1. Field Engineering and Surveying: Section 01050.
2. Shop Drawings: Section 01340.

##### 1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format with section numbers as provided herein.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the Engineer.

- E. As a prerequisite for monthly Progress payments, the Contractor is to exhibit the currently updated "Record Documents" for review by the Engineer.

#### 1.03 MARKING DEVICES

- A. Provide felt tip making pens for recording information in the color code designated by the Engineer.

#### 1.02 RECORDING

- A. Label each document "PROJECT RECORD" in neat large printed letters.
- B. Record information concurrently with construction progress.
  - 1. Do not conceal any work until required information is recorded.
- C. Drawings: Legibly mark to record actual construction:
  - 1. Depths of various elements of foundation in relation to finish first floor datum.
  - 2. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc.
  - 3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
  - 4. Field changes of dimension and detail.
  - 5. Changes made by Field Order or by Change Order.
  - 6. Details not on original Contract Drawings.
  - 7. Equipment and piping relocations.
  - 8. Major architectural and structural changes including relocation of doors, windows, etc.
  - 9. Architectural schedule changes according to Contractor's records and shop drawings.
- D. Specifications and Addenda: Legibly mark each section to record:
  - 1. Manufacturer, trade name, catalog number of Supplier of each product and item of equipment actually installed.
  - 2. Changes made by Field Order or by Change Order.



- E. Shop Drawings (after final review and approval): Provide five (5) sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

#### 1.04 SUBMITTAL

- A. At Contract closeout, deliver Record Documents to the Engineer for the Owner.
- B. Accompany submittal with transmittal letter in duplicate, containing:
  - 1. Date.
  - 2. Project title and number.
  - 3. Contractor's name and address.
  - 4. Title and number of each Record Document.
  - 5. Signature of Contractor or his authorized representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

## SECTION 01730

### OPERATING AND MAINTENANCE DATA

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract.
  - a. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.
2. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

###### B. Related Requirements Described Elsewhere:

1. General Requirements: Division 1.
2. Special Construction: Division 13.
3. Mechanical: Division 15.
4. Electrical: Division 16.

##### 1.02 QUALITY ASSURANCE

###### A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of described products.
2. Familiar with requirements of this Section.
3. Skilled as technical writer to the extent required to communicate essential data.
4. Skilled as draftsman competent to prepare required drawings.

##### 1.03 FORM OF SUBMITTALS

- ###### A.
1. Prepare data in form of an instructional manual for use by Owner's personnel.

B. Format:

1. Size: 8-1/2 inches x 11 inches.
2. Paper: 20 pound minimum, white, for typed pages.
3. Text: Manufacturer's printed data, or neatly typewritten.
4. Drawings:
  - a. Provide reinforced punched binder tab, bind in with text.
  - b. Reduce larger drawings and fold to size of text pages but not larger than 14 inches x 17 inches.
5. Provide fly-leaf for each separate product, or each piece of operating equipment.
  - a. Provide typed description of projects and major component parts of equipment.
  - b. Provide identified tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
  - a. Title of Project.
  - b. Identity of separate structure as applicable.
  - c. Identity of general subject matter covered in the manual.
7. Provide electronic versions of each submittal in an editable and searchable PDF format with bookmarks for each section.

C. Binders:

1. Commercial quality, three D-ring type binders with durable and cleanable white plastic covers. Binders shall be presentation type with clear vinyl covers on front, back and spine. Binders shall include two sheet lifters and two, horizontal inside pockets.
2. Maximum D-ring width: 2 inches.
3. When multiple binders are used, correlate the data into related consistent groupings.

#### 1.04 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.

1. Contractor, name of responsible principal, address and telephone number.
2. A list of each product required to be included, indexed to content of the volume.
3. List, with each product, name, address and telephone number of:
  - a. Subcontractor, manufacturer and installer name, addresses and telephone numbers.
  - b. A list of each product required to be included, indexed to content of the volume.
  - c. Identify area of responsibility of each.
  - d. Local source of supply for parts and replacement equipment including name, address and telephone number.
4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data:

1. Include only those sheets which are pertinent to the specific product.
2. Annotate each sheet to:
  - a. Clearly identify specific product or part installed.
  - b. Clearly identify data applicable to installation.
  - c. Delete references to inapplicable information.
3. Operation and maintenance information as herein specified.
4. Record shop drawings as submitted and approved with all corrections made for each product.

C. Drawings:

1. Supplement product data with drawings as necessary to clearly illustrate:
  - a. Relations of component parts of equipment and systems.

- b. Control and flow diagrams.
  - 2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
  - 3. Do not use Project Record Documents as maintenance drawings.
- D. Written test, as required to supplement product data for the particular installation:
  - 1. Organize in consistent format under separate headings for different procedures.
  - 2. Provide logical sequence of instruction of each procedure.
- E. Copy of each warranty, bond and service contract issued.
  - 1. Provide information sheet for Owner's personnel, give:
    - a. Proper procedures in event of failure.
    - b. Instances which might affect validity of warranties or bonds.

#### 1.05 MANUAL FOR MATERIALS AND FINISHES

- A. Submit two (2) copies of complete manual in final form and two (2) electronic copies in PDF format with bookmarks for each section.
- B. Content: for architectural products, applied materials and finishes:
  - 1. Manufacturer's data, giving full information on products.
    - a. Catalog number, size, composition.
    - b. Color and texture designations.
    - c. Information required for reordering special manufacturing products.
  - 2. Instructions for care and maintenance.
    - a. Manufacturer's recommendation for types of cleaning agents and methods.
    - b. Cautions against cleaning agents and methods which are detrimental to product.
    - c. Recommended schedule for cleaning and maintenance.
- C. Content, for moisture protection and weather-exposed products:
  - 1. Manufacturer's data, giving full information on products.

- a. Applicable standards.
  - b. Chemical composition.
  - c. Details of installation.
- 2. Instructions for inspection, maintenance and repair.
- D. Additional requirements for maintenance data: Respective sections of Specifications.

#### 1.06 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit six (6) copies of complete manual in final form and six (6) electronic copies (PDF format with bookmarks for each section).
- B. Content, for each unit of equipment and system, as appropriate:
  - 1. Description of unit and component parts.
    - a. Function, normal operating characteristics, and limiting conditions.
    - b. Performance curves, engineering data and tests.
    - c. Complete nomenclature and commercial number of replaceable parts.
    - d. Summary of information listed on equipment and motor data plates.
  - 2. Operating procedures:
    - a. Start-up, break-in, routine and normal operating instructions.
    - b. Regulation, control, stopping, shut-down and emergency instructions.
    - c. Summer and winter operating instructions.
    - d. Special operating instructions.
  - 3. Maintenance procedures:
    - a. Routine operations.
    - b. Guide to "trouble-shooting".
    - c. Disassembly, repair and reassembly.
    - d. Alignment, adjusting and checking.
  - 4. Servicing and lubrication required.
  - 5. Manufacturer's printed operating and maintenance instructions.
  - 6. Description of sequence of operation by control manufacturer.
  - 7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    - a. Predicted life of parts subject to wear.
    - b. Items recommended to be stocked as spare parts.

8. As-installed control diagrams by controls manufacturer.
  9. Each Contractor's coordination drawings.
    - a. As-installed color coded piping diagrams.
  10. Charts of valve tag numbers, with location and function of each valve.
  11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
  12. Other data as required under pertinent sections of specifications.
  13. Approved record shop drawings with all corrections made, and a copy of the warranty statement, checkout memo, demonstration test procedures and demonstration test certification.
- C. Content, for each electric and electronic systems, as appropriate:
1. Description of system and component parts.
    - a. Function, normal operating characteristics, and limiting conditions.
    - b. Performance curves, engineering data and tests.
    - c. Complete nomenclature and commercial number of replaceable parts.
  2. Circuit directories and panelboards.
    - a. Electrical service.
    - b. Controls.
    - c. Communications.
  3. As installed color coded wiring diagrams.
  4. Operating procedures:
    - a. Routine and normal operating instructions.
    - b. Sequences required.
    - c. Special operating instructions.

5. Maintenance procedures:
    - a. Routine operations.
    - b. Guide to "trouble-shooting".
    - c. Disassembly, repair and reassembly.
    - d. Adjustment and checking.
  6. Manufacturer's printed operating and maintenance instructions.
  7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
  8. Other data as required under pertinent sections of specifications.
- D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

#### 1.07 SUBMITTAL SCHEDULE

- A. Submit two (2) copies of preliminary draft of proposed formats and outlines of contents of Operation and Maintenance Manuals within 90 days after Notice to Proceed.
- B. Submit two (2) copies of completed data in preliminary form no later than 20 days following Engineer's review of the last shop drawing of a product and/or other submittal specified under Section 01340, but no later than delivery of equipment. One (1) copy will be returned with comments to be incorporated into the final copies and the other copy will be retained on-site for use in any early training.
- C. Submit six (6) copies of approved manual in final form directly to the offices of the Engineer within 10 days after the reviewed copy or last item of the reviewed copy is returned.
- D. Provide six (6) copies of addenda to the operation and maintenance manuals as applicable and certificates as specified within 30 days after final inspection.

#### 1.08 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to demonstration test, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.



- B. Operating and maintenance manual shall constitute the basis of instruction. Review contents of manual with Owner's operating and maintenance personnel in full detail to explain all aspects of operations and maintenance.
- C. All on-site training shall require both classroom instruction and field instruction. Allow designated Owner's personnel to attend each session for each major system and equipment. A minimum of two (2) days shall be allotted for each session, unless additional time is required in the individual equipment specifications.
- D. Instructors shall be fully qualified personnel as outlined within the individual equipment specifications. If no specific training specifications are listed with the equipment, the Contractor shall provide the instruction with qualified Contractor personnel.
- E. The Contractor shall provide a list to the Owner indicating the proposed date, time and instructors that will be present for all training sessions. The Owner will review and approve the training schedule prior to training events and facilitate the classroom training location as needed.
- F. The instructors shall provide for and prepare lesson scopes and handouts for individuals designated by the Owner that outline the items to be covered. Separate sessions for operation and maintenance instruction shall be provided consecutively. Handouts shall be submitted to the Owner with at least one week's notice prior to the training sessions.
- G. All instruction sessions shall be recorded using high definition, 1080p quality recording equipment. The Contractor shall provide training videos that are produced in both standard definition (DVD format) as well as a master recording that is provided in high definition (BluRay Disc) format. Recordings shall be made by the Contractor under the direction of the Owner and shall include audio recording.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

## SECTION 01740

### WARRANTIES AND BONDS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Scope of Work:
  - 1. Compile specified warranties and bonds as specified in these Specifications.
- B. Related Work Described Elsewhere:
  - 1. Contract Closeout: Section 01700.

##### 1.02 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: Two (2) each.
- C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
  - 1. Product of work item.
  - 2. Firm, with name of principal, address and telephone number.
  - 3. Scope.
  - 4. Date of beginning of 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.

##### 1.03 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.

- B. Format:
1. Size 8 1/2 inches by 11 inches, punched sheets for standard three (3) ring 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 (3) D-ring type binders with durable and cleanable white plastic covers and maximum D-ring width of two (2) inches. Binders shall be presentation type with clear vinyl covers on front, back, and spine. Binders shall include two sheet lifters and two horizontal inside pockets.

#### 1.04 WARRANTY SUBMITTALS 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 final acceptance by the Owner.
- B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under Divisions 11: Equipment; 13: Special Construction; 15: Mechanical; and 16: Electrical and which has at least a 1 hp motor or which lists for more than \$1,000. 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.
- C. In the event that the equipment manufacturer or supplier is unwilling to provide a one (1) year warranty commencing at the start of the Correction Period, the Contractor shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery to the job site. This two (2) year warranty from the manufacturer shall not relieve the Contractor of the one (1) year warranty, starting at the time of Owner's acceptance of the equipment.
- D. The Owner shall incur no labor or equipment cost during the guarantee period.
- E. Guarantee shall cover all necessary labor, equipment, materials, and replacement parts resulting from faulty or inadequate equipment design, improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all equipment and components furnished by the manufacturer or the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

## SECTION 02100

### SITE PREPARATION

#### PART 1 -- GENERAL

##### 1.1 THE REQUIREMENT

- A. The work of this Section includes measures required during the Contractor's initial mobilization onto the Site to protect existing fences, houses and associated improvements, streets, and utilities downslope of construction areas from damage due to boulders, trees or other objects dislodged during the construction process; clearing, grubbing and stripping; and regrading of certain areas to receive embankment fill. Contractors shall fully comply with the requirements of Ch. 556, F.S. including but not limited to notifying utility owners and providing the required information through the Sunshine One Call of Florida, Inc. (811) System, not less than two full business days in advance of beginning any construction.

##### 1.2 SITE INSPECTION

- A. Prior to moving onto the Site, the Contractor shall inspect the Site conditions and the Owner's property and right-of-way lines.
- B. The Contractor's attention is directed to any Soil Erosion and Sediment Control Ordinances in force. The Contractor shall comply with all applicable sections of these ordinances and NPDES requirements.

#### PART 2 -- PRODUCTS (NOT USED)

#### PART 3 -- EXECUTION

##### 3.1 PRIMARY SITE ACCESS

- A. The Contractor shall develop any necessary access to the Site, including access barriers to prohibit entry of unauthorized persons.
- B. Utility Interference: Where existing utilities interfere with the WORK, notify the utility owner and the Owner before proceeding per Section 01530 Protection of Existing Facilities.

##### 3.2 CLEARING AND GRUBBING

- A. Except as otherwise directed the Contractor shall cut, grub, remove and dispose of all trees, stumps, brush, shrubs, roots and any other objectionable material within the limits of the construction.
- B. All trees, stumps, brush, shrubs, roots and other objectionable material shall be cut, grubbed, removed and disposed of from areas needed to construct buildings, structures, roads, pipelines and any other areas to be stripped.

- C. Contractor shall protect trees or groups of trees, designated by the Owner to remain, from damage by all construction operations by erecting suitable barriers, or by other approved means. Clearing operations shall be conducted in a manner to prevent falling trees from damaging trees designated to remain.
- D. Areas outside the easements or limits of clearing shall be protected from damage and no equipment or materials shall be stored in these areas, unless prior written permission is granted before use of these areas.
- E. No stumps, trees, limbs, or brush shall be buried in any fills or embankments.

### 3.2 STRIPPING

- A. The Contractor shall strip topsoil from all areas to be excavated or filled. Avoid mixing topsoil with subsoil and stockpile topsoil in areas on the Site as approved by the Owner. Topsoil shall be free from brush, trash, large stones and other extraneous material and protected until it is placed as directed. Dispose of any remaining topsoil as directed by the Owner.

### 3.3 DISPOSAL OF MATERIALS

- A. All tree trunks, limbs, roots, stumps, brush, foliage, other vegetation and objectionable material shall be removed from the Site and disposed of in a manner satisfactory to the Owner. Disposal (including hauling) of cleared, grubbed, and unsuitable material and debris shall be the responsibility of the Contractor.
- B. Burning of cleared and grubbed materials will not be permitted.

### 3.4 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

- A. The Contractor shall avoid unnecessary disturbance of private property along the route of the construction.
- B. The Contractor shall clean up the construction site across private property immediately after construction is completed.

### 3.5 PRESERVATION OF PUBLIC PROPERTY

- A. The appropriate paragraphs of Articles 3.1, 3.2, and 3.4 of these specifications shall apply to the preservation and restoration of public lands, parks, rights-of-way, private easement, public utility easement, and all other damaged areas.

### 3.6 EXCAVATED MATERIALS UNSUITABLE FOR CONVENTIONAL DISPOSAL

- A. It will be the Contractor's responsibility to properly dispose of materials unsuitable for conventional disposal. The cost of disposal shall be included in the Contractor's Bid Price.

- END OF SECTION -

## SECTION 02140

### DEWATERING

#### PART 1 -- GENERAL

##### 1.1 THE REQUIREMENT

- A. The Contractor shall provide all labor, materials, and equipment necessary to dewater trench and structure excavations, in accordance with the requirements of the contract Documents. The Contractor shall secure all necessary permits to complete the requirements of this Section of the Specifications.

##### 1.2 QUALITY CONTROL

- A. It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.
- B. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.
- C. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement, which may develop. The responsibility for conducting the dewatering operation in a manner, which will protect adjacent structures and facilities, rests solely with the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.
- D. All dewatering shall comply with the regulations of the South Florida Water Management District and any other agency with jurisdiction.

#### PART 2 -- PRODUCTS

##### 2.1 EQUIPMENT

- A. Dewatering may include the use of well points, deep wells, and temporary pipelines for water disposal. The temporary pipelines shall not be used as permanent piping for the WORK. Standby pumping equipment shall be maintained on the jobsite.

#### PART 3 -- EXECUTION

##### 3.1 GENERAL REQUIREMENTS

- A. The Contractor shall provide all equipment necessary for dewatering. It shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent workmen for the operation of the pumping equipment.

Adequate standby equipment shall be kept available at all times to assure efficient dewatering and maintenance of dewatering operation during power and or mechanical failure.

- B. Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.
- C. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.
- D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
- E. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with crushed rock meeting FDOT Specification No.57 gradation requirements.
- F. The Contractor shall maintain the water level one-foot below the bottom of excavation in all work areas where groundwater occurs during excavation, construction, backfilling, and testing.
- G. The Contractor shall prevent flotation by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible and liable for all damages, which may result from failure to adequately keep excavations dewatered.
- H. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation. IMMEDIATELY UPON WITHDRAWAL OF WELL POINTS, THE Contractor SHALL BACKFILL THE HOLE WITH CLEAN SAND, BEDDING ROCK MEETING FDOT No. 89 GRADATION REQUIREMENTS OR EQUAL.
- I. The Contractor shall dispose of water from the WORK in a suitable manner without damage to adjacent property. The Contractor shall be responsible for obtaining any permits that may be necessary to dispose of water. No water shall be drained into work built or under construction unless hydraulic compaction is employed as their means of compaction and with prior approval of the Owner. Water shall be filtered using an approved method to remove sand and fine-sized soil particles before disposal into any drainage system.
- J. The reestablishment of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines, and sewers.



- K. Contractor shall provide sound attenuating structures for the above ground pumps as required and directed by the Owner.

- END OF SECTION -

## SECTION 02150

### TRENCH SAFETY

#### PART 1 -- GENERAL

##### 1.1 THE REQUIREMENT

- A. The Contractor shall provide Trench Safety in accordance with the Florida Trench Safety Act to ensure worker safety at the construction site. The Contractor shall be responsible for the implementation and maintenance of trench safety standards.

##### 1.2 SUBMITTALS

- A. The Contractor shall prepare and submit a trench safety plan which shall include the means to be utilized and the conditions determining which type of trench safety standard(s) will be used during construction.
- B. The trench safety plan shall include the names, positions, experience, and training information of "Competent Persons", who shall assure the implementation of the measures and standards for complying with the Florida Trench Safety Act.

#### PART 2 -- PRODUCTS (NOT USED)

#### PART 3 -- EXECUTION

- 3.1. The Contractor shall provide Trench Safety measures as required and shall maintain the necessary supervision on site at all times to assure the Trench Safety requirements are being implemented on their project. The Contractor shall monitor his Subcontractors to assure they comply also with the Florida State Trench Safety Act.

END OF SECTION

## SECTION 02200

### EARTHWORK

#### PART 1 -- GENERAL

##### 1.1 THE REQUIREMENT

- A. The Contractor shall perform all earthwork indicated and required for construction of the work, complete and in place, in accordance with the Contract Documents. The Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform the work.
- B. The Contractor shall examine the site, and review the results of subsurface investigations provided including soil borings, prior to commencing the work. In particular, the Contractor shall make a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which may arise as a result of nearby water courses and flood plains, especially in areas where construction activities may encounter water bearing sands and gravels. The Contractor shall make his own investigations necessary to determine ground conditions at the project site.
- C. Any damage caused by the Contractor's excavation, backfill, or compaction efforts will be the sole responsibility of the Contractor to repair, at no expense to the Owner.

##### 1.2 QUALITY CONTROL

- A. The Contractor shall engage the services of a qualified testing firm which is approved by the Owner to provide quality control testing and inspection services during earthwork operations as required in the Contract Documents. The Contractor shall provide the testing firm access to the site and earthwork under construction at such times as the testing firm requests and as necessary for testing of the work.

##### 1.3 QUALITY ASSURANCE BY OTHERS

- A. The Owner may utilize its own personnel or retain its own testing firm to perform quality assurance of the quality control functions performed by the Owner. The quality assurance function is to confirm and document the accuracy of testing provided by the Testing Laboratory. The Owner and the Contractor shall cooperate with the Owner's quality assurance program and shall provide access and samples when requested.

##### 1.4 CONTRACTOR SUBMITTALS

- A. The Contractor shall provide access for the Testing Laboratory to the source location of all bedding and backfill materials proposed to be used in the work in accordance with the requirements in Section 01340 – Shop Drawings. The sample sizes shall be as determined by the Testing Laboratory.

- B. The Contractor shall provide submittals for any alternative methods of placement of materials, in accordance with the requirements in Section 01340 – Shop Drawings.
- C. Submit to the Engineer for review the proposed methods of construction, including dewatering, excavation, bedding, filling, compaction and backfilling for the various portions of the work. Review shall be for information only. The Contractor shall remain responsible for the adequacy and safety of the methods. Where sheeting and bracing is required for construction, the design shall be performed by a Professional Engineer.
- D. Submit to the Engineer for review the Report, as performed by a Professional Engineer, that indicates all muck has been removed from the proposed project area and that backfilling has been conducted in substantial accordance with the project specifications herein.

## PART 2 -- PRODUCTS

### 2.1 MATERIAL REQUIREMENTS

- A. General: Materials for use as bedding and backfill, whether insitu or borrow, shall be as described herein. Fill, backfill, and embankment materials shall be suitable materials selected from the onsite operations or processed clean, fine earth, rock, or sand, free from grass, roots, brush, or other organic material.
- B. Common Fill: Common fill material shall be non-cohesive and shall consist of mineral soil, substantially free of clay, organic material, loam, wood, trash and other objectionable material which may be compressible or which cannot be properly compacted. Common fill shall not contain stones larger than 6 inches in any dimension, asphalt, broken concrete, masonry, rubble or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Additionally, common fill shall be no more than 12 percent by weight finer than the No. 200 mesh sieve unless finer material is approved for use in a specific location by the Owner.
- C. Select Common Fill: Select common fill material shall be as specified above from common fill, with the exception that the material shall contain no stones more than 1-1/2 inches in largest dimension, and shall be no more than 5 percent by weight finer than the No. 200 mesh sieve.
- D. Bedding Rock: Bedding rock material used in pipe trench within pipe zone, under abutments, and under concrete structures shall be crushed stone or gravel meeting the gradation and durability requirements of FDOT No. 89 and FDOT No.57 stone, as indicated on the Contract Drawings. With written approval from the Owner, number 131 and 132 Screenings may be substituted for FDOT No. 89 and FDOT No. 57 stone.
- E. Structural Fill: Materials for structural fill shall be bedding rock or select common fill as specified herein or suitable material as approved by the Owner.
- F. Unsuitable Material: Materials deemed not suitable for use on the project by the Owner.

## 2.2 USE OF FILL, BACKFILL, AND BEDDING MATERIAL TYPES

- A. Backfill and bedding material types shall be used as indicated in the Drawings.
- B. Structural Fill shall be used as backfill against the exterior walls of structures, or as shown on the Contract Drawings.

## PART 3 -- EXECUTION

### 3.1 EXCAVATION - GENERAL

- A. General: Excavation shall include the removal of all existing soil materials encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of these materials shall conform to the lines and grades indicated in the Contract Drawings. Where indicated, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. Excavations shall be sloped or otherwise supported in a safe manner in accordance with the Florida Trench Safety Act and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926). The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations.
- B. Sheet piling and Bracing:
  - 1. Furnish, put in place, and maintain sheet piling and bracing as required to support the sides of excavations, to prevent movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other approved methods. If the Owner is of the opinion that sufficient or proper supports have not been provided, the Owner may order additional supports be installed at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids besides the sheet piling, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the Owner.
  - 2. The Contractor shall construct sheet piling outside the neat lines of the foundation unless another configuration is desirable for his method of operation. Sheet piling shall be plumb and securely braced and tied in position. Sheet piling and bracing shall withstand all pressure to which the structure or trench will be subjected. Any deformation shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.
  - 3. Where sheet piling and bracing is required for construction, the Contractor shall engage a Professional Engineer, registered in the State of Florida, to design the sheet piling and bracing. The sheet piling and bracing installed shall conform to the design, and certification of this shall be provided by the Professional Geotechnical Engineer. The Owner reserves

the right to require sheeting and bracing where it is deemed necessary, at the sole discretion of the Owner.

4. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.
5. The Contractor shall leave in place to be embedded in the backfill, all sheeting and bracing not shown on the Drawings but which the Owner directs him in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to structures, utilities, or property, whether public or private. The Owner may direct that timber used for sheeting and bracing be cut off at any specified elevation.
6. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction, or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted for that purpose, or otherwise directed by the Owner.
7. The right of the Owner to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.
8. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than one (1) foot above the top of any pipe.

C. Pumping and Drainage

1. All dewatering activities shall be in accordance with specification Section 02140 - Dewatering, when applicable.
2. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels as stipulated in Section 02140. The Contractor shall submit to the Engineer for review a plan for dewatering systems prior to commencing work. The installed dewatering system shall be in conformity with the overall construction plan. The Contractor shall be required to monitor the performance of the dewatering systems during the progress of the work and require such modifications as may be required to assure that the systems are performing satisfactorily.

3. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the bottom of the excavation and to preserve the integrity of adjacent structures. Well or sump installations shall be constructed with proper sand filters to prevent intermixing of finer grained soil from the surrounding ground.
4. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
4. The Contractor shall take all additional precautions to prevent buoyant uplift of any structure during construction.
6. The conveying of dewatered liquids in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. The Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the Owner or the authority having jurisdiction, at no cost to the Owner.
7. Flotation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.
8. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system, shall be removed by the Contractor.
9. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater quality.

### 3.2 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

- A. General: Excavations shall conform to the elevations and dimensions shown on the Contract Drawings within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removing formwork, installation of piping services and other construction, and inspection. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. Bottoms shall be trimmed to required lines and grades to leave a solid base to receive concrete.
- B. Excavation for Structures and Embankments: Except where otherwise indicated for a particular structure, excavation shall be carried to the grade of the bottom of the footing or slab. Where unsuitable materials are encountered at the bottom of a footing or slab, areas beneath the structures or fills shall be over-excavated and backfilled to grade with Structural Fill material compacted to the requirements of the adjacent fill material.

### 3.3 PIPELINE AND UTILITY TRENCH EXCAVATION

- A. General: Unless otherwise indicated or ordered, excavation for pipelines and utilities shall be open-cut trenches as indicated in the Contract Drawings.
- B. Trench Bottom: The bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe bedding.
- C. Open Trench: The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. For open trenches greater than 500 feet in length, pre-approval from the Owner must be obtained. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. If steel plates are used, no more than 40 feet in length along the trench will be allowed. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located more than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades, orange safety fences, and warning lights meeting safety requirements shall be provided and maintained.
- D. Over-Excavation: Where trenches or excavations are required to be over-excavated to remove unsuitable materials, the excavation shall be to the minimum depth required to remove the unsuitable material, and shall be backfilled with common fill to the grade of the bottom of the pipe bedding as indicated in the Contract Drawings. Classification of the material as unsuitable shall be made by a Owner approved testing laboratory based on test results and or inspection of the material in the excavation at the time of construction.
- E. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

### 3.4 ROCK EXCAVATION

- A. Rock excavation shall include removal and disposal of the following:
  - 1. All boulders and rock, which require breaking by the use of special equipment or extraordinary excavation methods (may include hammers, wrecking balls, rock trenchers, drills, or other approved equipment).
  - 2. All rock material in ledges, bedding deposits, and unstratified or conglomerate masses which cannot be removed using normal excavation methods and equipment.
- B. Rock excavation shall be performed by the Contractor. The cost for removal and disposal shall be included in the Contractor's Bid Price
- C. Blasting will not be permitted without prior written authorization of the Owner.

### 3.5 DISPOSAL OF EXCESS EXCAVATED MATERIAL



- A. The Contractor shall remove and dispose of all excess excavated material not suitable or required for use on the project at a site selected and obtained by the Contractor at his own expense. The removal shall be timely and the disposal of all excess excavated materials shall be performed at least once a month.
- B. Backfill replacement for unsuitable materials shall be provided from excess common fill available from on-site stockpiles. Refer also to Section 02100 – Site Preparation.
- C. The Contractor shall obtain all required permits, landowner, and agency approvals for disposal of excess excavated material and shall pay all costs associated with the removal and disposal.
- D. Depositing clean fill on private property will not be permitted unless the property owner possesses a current building permit that requires fill. Contractors shall provide proof of said permit to the Engineer for review and approval prior to placing clean fill on the permitted property.

### 3.6 BACKFILL - GENERAL

- A. The Contractor shall examine the areas and conditions under which excavating, filling and grading are to be performed, and shall not proceed with the work until unsatisfactory conditions have been corrected. The Contractor shall examine existing grade prior to commencement of the work and report to the Owner if elevations of existing grade vary from elevations shown on the Drawings.
- B. The Contractor shall employ a qualified testing laboratory for all testing required. The Contractor shall notify the Owner a minimum of 48 hours in advance of any scheduled testing.
- C. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength (minimum of 75% of the 28-day design strength) to support the loads imposed.
- D. Except for rock bedding materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation, and the trench sidewalls and bottom have been dried to a moisture content suitable for compaction.
- E. If a moveable trench shield is used during excavation, pipe installation, and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally, The Contractor shall not drag trench shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.
- F. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have all loose sloughing, or caving soil and rock materials removed. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.
- G. The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the Drawings. No soft spots or uncompacted areas will be allowed in the work.

- H. Backfill shall be compacted to 98 percent of maximum density (AASHTO T-180) under structures and paved areas, and 95 percent of maximum density (AASHTO T-180) elsewhere unless otherwise indicated on the drawings.

### 3.7 PLACING AND SPREADING OF BACKFILL MATERIALS

- A. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that when compacted, each layer shall not exceed 6 inches in thickness. Thicker lifts of backfill may be permitted when the Contractor has satisfactorily demonstrated that proper compaction has been achieved with the methods and materials in use. The use of thicker lifts will be at the sole discretion of the Owner.
- B. The use of flooding and jetting methods to achieve compaction may be permitted upon approval. The Contractor shall submit methods documenting procedures to be utilized for approval to the Engineer and for the Owner for final approval.
- C. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Backfill around pipes shall be manually spread around the pipe so that when compacted the backfill will provide uniform bearing and side support.
- D. Where the backfill material moisture content is below the optimum moisture content, water shall be added before or during spreading until the proper moisture content is achieved.
- E. Where the backfill material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.
  - 1. Backfilling shall be carried up evenly on all walls of an individual structure. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength (minimum of 75% of the 28-day design strength).
  - 2. Bedding rock shall be used for bedding under all structures and pipe as indicated on the Drawings. The Contractor shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of the bedding.
  - 3. In locations where pipes pass through structure walls, Structural Fill shall be placed for a distance of not less than 3 feet either side of the vertical center line of the pipe and the Contractor shall make special efforts to consolidate the fill up to the horizontal centerline of the pipe.

### 3.8 COMPACTION OF FILL, BACKFILL, AND BEDDING MATERIALS

- A. Any damage caused by the Contractor's compaction efforts will be the sole responsibility of the Contractor to repair, at no expense to the Owner.
- B. Each layer of backfill materials shall be compacted to the density indicated on the Drawings. A compacted effort approved by the Owner shall be employed to compact backfill layers before the water table is reestablished. Equipment that is consistently capable of

achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.

- C. Hydraulic compaction will be an acceptable alternative under certain soil conditions. Contractor shall submit methods to the Owner for approval.
- D. Flooding, ponding, or jetting shall not be used for backfill around structures, for final backfill materials, or aggregate base materials without written authorization of the Owner.
- E. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the depth of the fill. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.

### 3.9 PIPE AND UTILITY TRENCH BACKFILL

- A. Backfilling over and around pipes shall begin as soon as practical after the pipe has been laid, jointed and inspected.
- B. After compacting the bedding the Contractor shall perform a final trim using a stringline or other method for establishing grade, such that each pipe section when laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for pipe bells shall be made as required.
- C. Bedding and backfill under, around and over pipes shall be compacted using light, hand operated, vibratory compactors and rollers. After completion of at least two feet of compacted backfill over the top of pipeline, heavier compaction equipment may be used to complete the trench backfill.
- D. If a moveable trench shield is used during backfill operations the shield shall be lifted so as to not displace the pipe or backfill while the shield is being moved.
- E. See Collier County technical specifications for requirements on locating wire and early warning detection tape.

### 3.10 FILL AND EMBANKMENT CONSTRUCTION

- A. The area where a fill or embankment is to be constructed shall be cleared of all vegetation, roots and organic material. The surface shall be moistened, scarified to a depth of 6 inches, and rolled or otherwise mechanically compacted. Embankment and fill material shall be placed and spread evenly in approximately horizontal layers. Each layer shall be moistened or aerated, as necessary. Each layer shall not exceed 6 inches of compacted thickness. The embankment, fill, and the scarified layer of underlying ground shall be compacted.
- B. When an embankment or fill is to be made and compacted against hillsides or fill slopes steeper than 4:1, the slopes of hillsides or fills shall be horizontally benched to key the embankment or fill to the underlying ground. A minimum of 12 inches normal to the slope of the hillside or fill shall be removed and re-compacted as the embankment or fill is brought up in layers. Material

thus cut shall be re-compacted along with the new material at no additional cost. Hillside or fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

- C. Where embankment or structure fills are constructed over pipelines, the first 2 feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe. Heavy construction equipment shall maintain a minimum distance from the edge of the trench equal to the depth of the trench until at least 2 feet of fill over the pipe has been completed.

### 3.11 QUALITY CONTROL TESTING

- A. Compaction Tests: Three compaction test locations shall normally be required for each lot. A Lot shall not exceed 300 linear feet of pipe or 100 square feet of backfill around structures, or as shown on the Drawings. The locations of the compaction tests within the trench shall be in conformance with the following schedule:
  - 1. One test at the spring line of the pipe.
  - 2. One test at an elevation of one foot above the top of the pipe.
  - 3. One test for each 2 feet of backfill placed from one foot above the top of the pipe to finished grade elevation.
  - 4. At least two test locations are required for each trench crossing existing pavement.
  - 5. Vaults: A minimum of two tests for every 2 twelve inch (12") lifts of backfill. Tests will be taken no less than 6 inches or no more than 3 feet away from each structure alternating around the structure.
- C. In case the test of the fill or backfill show non-compliance with the required density, the Contractor shall accomplish such remedy as may be required to ensure compliance.
- D. The Contractor shall provide test trenches and excavations including excavation, trench support, and groundwater removal for the soils testing operations. The trenches and excavations shall be provided at the locations and to depths required by the testing firm. All work for test trenches and excavations shall be provided at no additional cost.

END OF SECTION

## SECTION 02240

### STABILIZED SUBGRADE

#### PART 1- GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. The work specified in this section consists of the construction of a stabilized roadway subgrade where indicated on the Drawings. Construction shall be to the uniformity, density and bearing ratio specified hereinafter. Paved areas shall be stabilized to a minimum depth of 12 inches below the bottom grade of the base material and to a width 12 inches outside of pavement or concrete curb edge.

###### B. Definitions: The stabilizing shall be FDOT Type B as described hereinafter. The required bearing ratio value shall be obtained either by constructing the subgrade or selected materials from the roadway and borrow area(s), or by stabilizing the subgrade material by the addition and mixing in of suitable stabilizing material. Such work shall be done in accordance with these specifications, lines, grades, thicknesses and notes shown on the Drawings.

###### C. Applicable Codes, Standard and Specifications: The road construction under this contract shall be in strict accordance with the applicable provisions of the following:

1. The Florida Department of Transportation (FDOT) "Standard Specifications for Road and Bridge Construction" (Latest Edition).
2. American Association of State Highway and Transportation Officials (AASHTO).
3. American Society for Testing and Materials (ASTM).
4. County and City codes and Standards.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

###### A. General: The particular type of stabilizing material to be used shall be in accordance with Paragraph 2.01.E hereinafter and shall meet the following requirements.

B. Use Of Materials From Existing Base:

1. Removal of any section of existing base shall not be done until the need for it in maintaining traffic is fulfilled.
2. Existing shell or limerock base material may be reutilized as an admixture for stabilized subgrade.

C. Commercial Materials

1. General: Materials which are designated as Commercial- Materials which are to be used for this stabilizing may be commercial limerock, limerock overburden or shell approved by Engineer.
2. Limerock: Specific requirements for limerock and limerock overburden: For limerock and limerock overburden, the percentage of carbonates of calcium and magnesium shall be at least 70, and the plasticity index shall not exceed 10. The gradation of both commercial limerock and limerock overburden shall be such that 97 percent of these materials will pass a 1 1/2 inch sieve.
3. Crushed Shell: Crushed shell for this use shall be mollusk shell (i.e. oysters, mussels, clams, cemented coquina, etc.). Steamed shell will not be permitted. The shell shall meet the following requirements: at least 97% by weight of the total material shall pass a 3 1/2-inch screen and at least 50% by weight of the total material shall be retained on the No. 4 sieve. Not more than 20% by weight of the total material shall pass the No. 200 sieve. The determination of the percentage passing the No. 200 sieve shall be made by washing the material over the sieve.

D. Local Material:

1. General: Local materials used for this stabilizing may be high bearing value soils or sand-clay material. The material passing the 40-mesh sieve shall have a liquid not greater than 30 and a plasticity index not greater than 10.
2. Blending: No blending of materials to meet these requirements will be permitted unless authorized by the Engineer. When blending is permitted, the blended material shall be tested and approved before being spread on the roadway.

E. Type B Stabilization:

1. The type of materials, Commercial or Local, shall be at the Contractor's option.
2. No separate payment for stabilizing materials will be made.

3. Bearing Value determinations will be made by the Limerock Bearing Ratio Method.
4. Under this method, it shall be the Contractor's responsibility that the finished roadbed section meets the bearing value requirements, regardless of the quantity of stabilizing materials necessary to be added. Also under this method, full payment will be made for any areas where the existing sub-grade materials meet the design bearing value requirements without the addition of stabilizing additives, as well as areas where the Contractor may elect to place select high-bearing materials from other sources, within the limits of the stabilizing.
5. After the roadbed grading operations have been substantially completed, the Contractor shall make his own determination as to the quantity (if any) of stabilizing material, of the type selected by him, necessary for compliance with the bearing value requirements. The Contractor shall notify the Engineer of the approximate quantity to be added.

## PART 3 - EXECUTION

### 3.01 PREPARATION

#### A. General

1. Equipment: All equipment necessary for the proper construction of the work shall be on the project, in first-class working condition, and shall have been approved by the Engineer prior to its use.
2. Clear, grub and strip within limits of roadway. See Section 02100, Site Preparation.
3. Grade stakes shall be placed and maintained at 50 foot intervals along both sides of the proposed roadway. The Contractor shall demonstrate the specified grade to the Engineer prior to placement of stabilizer. Prior to the beginning of stabilizing operations, the area to be stabilized shall have been constructed to an elevation such that upon completion of stabilizing operations the completed stabilized subgrade will conform to the lines, grades and cross sections shown in the plans. Prior to the spreading of any additive stabilizing material, the surface of the roadbed shall be brought to a plane approximately parallel to the plane of the proposed finished surface.
4. The subgrade to be stabilized shall be processed in one course, unless the equipment and methods being used do not provide the required uniformity, particle size limitation, compaction and other desired results, in which case, the Engineer will direct that the processing be done in more than one course.

5. All manhole castings, valve boxes or other utility castings within the area to be surfaced shall be adjusted to the proposed surface elevation by the Contractor. The work shall be accomplished in such manner as to leave the casting fixed permanently in its correct position.

### 3.02 APPLICATION

#### A. Stabilizing Material:

1. When additive stabilizing materials are required, the designated quantity shall be spread uniformly over the area to be stabilized.
2. When materials from an existing base are to be utilized in the stabilizing at a particular location, all of such materials shall be placed and spread prior to the addition of other stabilizing additives.
3. Commercial stabilizing material shall be spread by the use of mechanical material spreaders except that where use of such equipment is not practicable other means of spreading may be used, but only upon written approval of the proposed alternate method.

#### B. Mixing:

1. The mixing shall be done with rotary tillers, or other equipment meeting the approval of the Engineer. The area to be stabilized shall be thoroughly mixed throughout the entire depth and width of the stabilizing limits.
2. The mixing operations, as specified, will be required regardless of whether the existing soils, or any select soils placed within the limits of the stabilized sections, have the required bearing value without the addition of stabilizing materials.
3. As an exception to the above mixing requirements, where the subgrade is of rock, the Engineer may direct that the mixing operations (and the work of stabilizing) be waived and no payment for stabilization will be made for such sections of the roadway.

- C. Maximum Particle Size of Mixed Materials: At the completion of mixing, all particles of material within the limits of the area to be stabilized shall pass a 3 1/2-inch ring. Any particles not meeting this requirement shall be removed from the stabilized area or shall be broken down so as to meet this requirement.

- D. Compaction: After the mixing operations have been completed and requirements for bearing value, uniformity and particle size have been satisfied, the stabilized area shall be compacted, in accordance with Paragraph 3.03.B hereinafter. The materials shall be compacted at a moisture content permitting the specified compaction. If the moisture



content of the material is improper for attaining the specified density, either water shall be added or the material shall be permitted to dry until the proper moisture content for the specified compaction is reached.

- E. Finish Grading: The completed stabilized subgrade shall be shaped to conform with the finished lines, grades and cross-section indicated in the Drawings to a tolerance of 0.05 feet. The subgrade shall be checked by the use of grade stakes and demonstrated to the Engineer.
- F. Requirements For Condition Of Completed Subgrade:
  - 1. After the stabilizing and compacting operations have been completed, the subgrade shall be firm and substantially unyielding, to the extent that it will support construction equipment and will have the bearing value required by the Drawings.
  - 2. All safe and yielding material, and any other portions of the subgrade which will not compact readily, shall be removed and replaced with suitable material and the whole subgrade brought to line and grade, with proper allowance for subsequent compaction.
- G. Maintenance Of Completed Subgrade: After the subgrade has been completed as specified above, the Contractor shall maintain it free from ruts, depressions and any damage resulting from the hauling or handling of materials, equipment, tools, etc. It shall be the Contractor's responsibility to maintain the required density until the subsequent base or pavement is in place. Such responsibility shall include any repairs, replacement, etc., of curb and gutter, sidewalk, etc., which might become necessary in order to recompact the subgrade in the event of underwash or other damage occurring to the previously compacted subgrade. Any such work required for recompaction shall be at the Contractor's expense. Ditches and drains shall be constructed and maintained along the completed subgrade section.

### 3.03 FIELD QUALITY CONTROL

- A. Bearing Value Requirements:
  - 1. General: Bearing value samples will be obtained and tested by a testing firm approved by the Engineer at completion of satisfactory mixing of the stabilized area. For any area where the bearing value obtained is deficient from the value indicated in the Drawings, in excess of the tolerances established herein, additional stabilizing material shall be spread and mixed in accordance with 3.02.B.1 and 3.02.B.2. This reprocessing shall be done for the full width of the roadway being stabilized and longitudinally for a distance of 50 feet beyond the limits of the area in which the bearing value is deficient.

2. Tolerances In Bearing Value Requirements: The following under-tolerances from the specified bearing value will be allowed based on tests performed on samples obtained after mixing operations have been completed:

<u>Specified Bearing Value</u>	<u>Under-tolerances</u>
LBR 40	0

- B. Density Requirements - General: Within the entire limits of the width and depth of the areas to be stabilized, the minimum density acceptable at any location will be 98 percent of the maximum density as determined by AASHTO T 180, Test Method D. Tests for the subbase compaction shall be spaced at a maximum of 300 feet apart and shall be staggered to the left, right, and on the centerline of the roadway or as directed by the Engineer. The Engineer may direct additional tests when in his opinion conditions warrant additional testing to assure compliance with specifications.

END OF SECTION

## SECTION 02269

### TEMPORARY EROSION CONTROL

#### PART 1 -- GENERAL

##### 1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide effective temporary erosion control and sediment control measures during construction or until permanent erosion controls become effective so as to prevent pollution of water, detrimental effects to public or private property adjacent to the project and damage to WORK on the project.
- B. The CONTRACTOR'S attention is called for complying with all necessary NPDES requirements during the execution of the WORK.
- C. All temporary erosion control measures shall be in accordance with FDOT specifications section 104 and 125. If a conflict exists between the FDOT and these Specifications, the Contractor shall bring that discrepancy to the attention of the Owner for clarification prior to construction.

##### 1.2 CONTRACTOR SUBMITTALS

- A. Submittals shall be in accordance with Section 01340 – Shop Drawings.
- B. Product Data: Manufacturer's catalog sheets on geotextile fabrics.

#### PART 2 -- PRODUCTS

##### 2.1 GENERAL

- A. Temporary erosion and water pollution control features consist of, but are not limited to, temporary grassing, temporary sodding, temporary mulching, turbidity barriers, and silt fence.

##### 2.2 SEEDING AND SODDING

- A. Seeding and sodding material will be in accordance with Section 02822 – Solid Sodding.

##### 2.3 FILTER FABRIC

- A. Fabric shall be woven or non-woven consisting of long-chain polymeric filaments or yarns such as polypropylene, polyethylene, polyester, or polyamid. The base plastic shall contain stabilizers and/or inhibitors to make the filaments resistant to deterioration due to ultra-violet light, heat exposure and chemicals. The fabric shall be free of any treatment that may significantly alter its physical properties. The edges of the fabric shall be salvaged or otherwise finished to prevent the outer yarn from pulling away from the fabric.

- B. Fabric shall have the following properties:

Parameter	Standard Method	Value
Grab tensile strength	ASTM D 4632	100 lb.
Burst strength	ASTM D 3786	200 psi
Apparent opening size	ASTM D 4751	Between 200 and 70 sieve size

- C. Fabric Manufacturer, or Approved equal:

1. Mirafi

## 2.4 FENCING

- A. Woven wire fabric fencing shall be galvanized, mesh spacing of 6 inches, maximum 14- gauge, at least 30 inches tall.

## 2.5 FASTENERS

- A. Fasteners to wood posts shall be steel, at least 1 1/2 inches long.
- B. Fasteners to steel posts shall be galvanized clips or tie wire.

## 2.6 SYNTHETIC BARRIERS

- A. All synthetic barriers shall be in accordance with FDOT specification 106-6.4.8. The use of hay bales is not permitted.

## PART 3 -- EXECUTION

### 3.1 GENERAL

- A. The CONTRACTOR shall prevent pollution of streams, canals, lakes, reservoirs, and other water impoundments with fuels, oils, bitumens, calcium chloride, or other harmful materials. The CONTRACTOR shall conduct and schedule operations to avoid or otherwise minimize pollution by siltation.
- B. Provide and maintain, for the duration of the project, erosion control barriers as required to prevent erosion and silt loss from the Site. Erosion control measures shall remain in place until an adequate stand of grass has been established, per FDOT standards.
- C. The CONTRACTOR shall not commence clearing, grubbing, earthwork, or other activities that may cause erosion until barriers are in place.

### 3.2 SEEDING AND SODDING

- A. Seeding and sodding shall be placed in accordance with Section 02822 – Solid Sodding.

### 3.3 HANDLING AND STORAGE

- A. The geotextile fabric shall be wrapped in a protective covering which is sufficient to protect it from sunlight, dirt, and other debris during shipment and storage.

### 3.4 INSTALLATION

- A. Barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.
- B. Attach the woven wire fencing to the posts that are spaced a maximum of 6 feet apart and embedded a minimum of 12 inches. Install posts at a slight angle toward the source of the anticipated runoff.
- C. Trench in the toe of the filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow. Lay fabric along the edges of the trench. Backfill and compact.
- D. Securely fasten the fabric materials to the woven wire fencing with tie wires or galvanized clips.
- E. Reinforced fabric barrier shall have a minimum height of 18 inches.
- F. Provide the filter fabric in continuous rolls and cut to the length of the fence to minimize the use of joints. When joints are necessary, splice the fabric together only at a support post with a minimum 6-inch overlap and seal securely.

### 3.5 MAINTENANCE

- A. Regularly inspect and repair or replace damaged components of the barrier. Unless otherwise directed, maintain the erosion control system until final acceptance; then remove erosion and sediment control systems promptly.
- B. Remove sediment deposits when silt reaches a depth of 6 inches or 1/2 the height of the barrier, whichever is less. Dispose of sediments at an acceptable site arranged by the CONTRACTOR that is not in or adjacent to a stream, floodplain, canal, lake, reservoir, or other water impoundments.
- C. During periods of heavy rain, the CONTRACTOR shall monitor the temporary erosion control measures to ensure that they are not causing localized flooding. The CONTRACTOR may be required to cut slits in the fabric to drain flooded areas. Fabric shall be replaced after heavy rain events.

- END OF SECTION -

## SECTION 02574

### ASPHALT PAVEMENT

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Scope of Work: Work included under this Section consists of installation of asphaltic concrete pavement as shown in the drawings and any miscellaneous cutting, removing, protecting and replacing existing pavements and driveways.
- B. Protection of Existing Improvements: The Contractor shall be responsible for the protection of all pavements, sidewalks and other improvements within the work area. All damage to such improvements, as a result of the Contractor's operations, beyond the limits of the work of pavement replacement as described herein, shall be repaired by the Contractor at his expense.

##### 1.02 SUBMITTALS

- A. Informational Submittals:
  - 1. Asphalt Concrete Mix Formula (in general accordance with Section 334 of FDOT Standard Specifications):
    - a. Submit minimum of 15 days prior to start of production.
    - b. Submittal to include the following information:
      - 1) Gradation and portion for each aggregate constituent used in mixture to produce a single gradation of aggregate within specified limits.
      - 2) Bulk specific gravity for each aggregate constituent.
      - 3) Measured maximum specific gravity of mix at optimum asphalt content determined in accordance with ASTM D2041.
      - 5) Percent of asphalt lost due to absorption by aggregate.
      - 6) Index of Retained Strength (TSR) at optimum asphalt content as determined by AASHTO T283.
      - 7) Percentage of asphalt cement, to nearest 0.1 percent, to be added to mixture.
      - 8) Optimum mixing temperature.
      - 9) Optimum compaction temperature.
      - 10) Temperature-viscosity curve of asphalt cement to be used.

- 11) Brand name of any additive to be used and percentage added to mixture.
2. Test Report for Asphalt Cement:
  - a. Submit minimum 10 days prior to start of production.
  - b. Show appropriate test method(s) for each material and the test results.
3. Manufacturer's Certificate of Compliance for the following materials:
  - a. Aggregate: Gradation, source test results.
  - b. Asphalt for Binder: Type, grade, and viscosity-temperature curve.
  - c. Prime Coat: Type and grade of asphalt.
  - d. Tack Coat: Type and grade of asphalt.
  - e. Additives.
  - f. Mix: Conforms to job-mix formula.
4. Statement of qualification for independent testing laboratory.
5. Test Results
  - a. Mix design.
  - b. Asphalt concrete core.
  - c. Gradation and asphalt content of uncompacted mix.
  - d. Field density.
  - e. Quality control.

#### 1.03 QUALITY ASSURANCE

##### A. Qualifications:

1. Independent Testing Laboratory: In accordance with ASTM E329.
2. Asphalt concrete mix formula shall be prepared by approved certified independent laboratory under the supervision of a certified asphalt technician.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

- A. Materials, including stabilized subgrade, base, bituminous prime and tack coat, and asphaltic concrete for the above work shall meet the requirements established herein.



1. Stabilized subgrade shall conform to Project Specification 02240 and Section 160 of the Florida Department of Transportation (FDOT) Standard Specification of Road and Bridge Construction (latest edition).
2. Base material shall be crushed concrete conforming to Graded Aggregate Base requirements specified in Section 204 of the FDOT Standard Specification of Road and Bridge Construction (latest edition).
3. Bituminous prime and tack coat materials shall conform to Section 300 of the FDOT Standard Specification of Road and Bridge Construction (latest edition) and section 02551.
4. Asphalt concrete shall match the pavement detail in the Drawings and conform to Section 334 of the FDOT Standard Specification of Road and Bridge Construction (latest edition).
5. Portland cement concrete shall conform to Section 350 of the FDOT Standard Specification of Road and Bridge Construction (latest edition).

### PART 3 - EXECUTION

#### 3.01 GENERAL

- A. Traffic Control:

NOT USED

#### 3.02 LINE AND GRADE

- A. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.

#### 3.03 APPLICATION EQUIPMENT

- A. In accordance with FDOT Standard Specifications.

#### 3.04 PREPARATION

- A. Prepare subgrade as specified in Project Specification 02240 and as shown in the drawings.
- B. Existing Asphalt:
1. Paint edges of meet line with tack coat prior to placing new pavement.

- C. Thoroughly coat edges of contact surfaces (curbs, manhole frames, valve covers) with emulsified asphalt or asphalt cement prior to laying new pavement, prevent staining of adjacent surfaces.

### 3.05 PAVEMENT APPLICATION

- A. General: Place asphalt concrete mixture on approved, prepared base in conformance with FDOT Standard Specifications.
- B. Tolerances:
  - 1. General: Conduct measurements for conformity with crown and grade immediately after initial compression. Correct variations immediately by removal or addition of materials and by continuous rolling.
  - 2. Completed Surface or Wearing Layer Smoothness:
    - a. Uniform texture, smooth, and uniform to crown and grade.
    - b. Maximum Deviation: 3 millimeters (1/8 inch) from lower edge of a 3.6-meter (12-foot) straightedge, measured continuously parallel and at right angle to centerline.
    - c. If surface of completed pavement deviates by more than twice specified tolerances, remove and replace wearing surface.
  - 3. Transverse Slope Maximum Deviation: 6 millimeters (1/4 inch) in 3.6 meters (12 feet) from rate of slope shown.
  - 4. Finished Grade:
    - a. Perform field differential level survey on maximum 15-meter (50-foot) meter grid and along grade breaks.
    - b. Maximum Deviation: 6 millimeters (0.02 foot) from grade shown.

### 3.06 FIELD QUALITY CONTROL

- A. General: Provide services of approved certified independent testing laboratory to conduct tests.
- B. Field Density Tests:
  - 1. Perform tests from cores or sawed samples in accordance with AASHTO T230 and AASHTO T166.

2. Measure with properly operating and calibrated nuclear density gauge in accordance with ASTM D2950.
  3. Maximum Density: In accordance with ASTM D2041, using sample of mix taken prior to compaction from same location as density test sample.
- C. Testing Frequency:
1. Quality Control Tests:
    - a. Asphalt Content, Aggregate Gradation: Once per every 400 mg (500 tons) of mix or once every 4 hours, whichever is greater.
    - b. Mix Design Properties, Measured Maximum (Rice's) Specific Gravity: Once every 900 mg (1,000 tons) or once every 8 hours, whichever is greater.
  2. Density Tests: Once every 450 mg (500 tons) of mix or once every 4 hours, whichever is greater.

END OF SECTION

## SECTION 02822

### SOLID SODDING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work

1. Furnish all labor, materials, equipment and incidentals required to prepare lawn bed and install sodding as specified.
2. All sodded areas disturbed by Contractor activities shall be replaced with like kind.

###### B. Related Work Described Elsewhere

1. Shop Drawings: Section 01340.
2. Earthwork: Section 02200.

##### 1.02 QUALITY ASSURANCE (NOT APPLICABLE)

##### 1.03 SUBMITTALS

- A. Provide technical data as required in Section 01340 regarding all materials or installation procedures required under this Section.
- B. Submit representative topsoil samples for analysis by a private laboratory to determine nutrient deficiencies and outline a proper fertilization program.

#### PART 2 - PRODUCTS

##### 2.01 GENERAL

- A. Loam (topsoil) shall be fertile, natural soil, typical of the locality, free from large stones, roots, sticks, peat, weeds and sod and obtained from naturally well drained areas. It shall not be excessively acid or alkaline nor contain toxic material harmful to plant growth. Topsoil stockpiled under other Sections of this Division may be used, but the Contractor shall furnish additional loam at his own expense, if required.

##### 2.02 SOIL CONDITIONERS

- A. Fertilizer:

1. Fertilizer shall be a complete fertilizer, the elements of which are derived from organic sources. Fertilizer shall be a standard product complying with State and Federal fertilizer laws.
  2. Fertilizer shall be 6% nitrogen, 6% phosphorus and 6% potash by weight. At least 50% of the total nitrogen shall contain no less than 3% water-insoluble nitrogen.
  3. Fertilizer shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear the manufacturer's guaranteed statement of analysis, or a manufacturer's certificate of compliance covering analysis shall be furnished to the Engineer. Store fertilizer in a weatherproof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.
- B. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes containing not less than 20 available phosphoric acid.
- C. Lime shall be ground limestone.

#### 2.03 SOD

- A. Sod shall match existing kind and be of firm texture having a compacted growth and good root development as approved.
- B. Sod shall be certified to meet Florida State Plant Board specifications, absolutely true to varietal type, and free from weeds or other objectionable vegetation, fungus, insects and disease of any kind.
- C. Before being cut and lifted the sod shall have been mowed 3 times with the final mowing not more than a week before cutting into uniform dimensions.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Areas to be sodded shall be cleared of all rough grass, weeds, and debris, and ground brought to an even grade as approved.
- B. The soil shall then be thoroughly tilled to a minimum 8 inch depth.
- C. Loam shall be placed to a minimum depth of 4 inches and shall be lightly compacted. No loam shall be spread in water.
- D. Lime shall be applied at a rate necessary to achieve a pH of 6 to 7.
- E. Apply superphosphate at a rate of 5 pounds per 1,000 square feet and apply fertilizer at a rate of 16 pounds per 1,000 square feet.

- F. 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.

### 3.02 INSTALLATION

- A. During delivery, prior to planting, and during the planting of the lawn 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 protected 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 and with the joints offset relative to upper and lower panels. Immediately following sod laying the lawn areas shall be rolled with a lawn roller customarily used for such purposes, and then thoroughly watered.
- C. Bring the sod edge in a neat, clean manner to the edge of all paving and shrub areas. Top dressing with approved, clean weed free sand may be required at no additional cost to the Owner if deemed necessary by the Engineer.

### 3.03 MAINTENANCE

- A. The Contractor shall produce a dense, well established lawn. The Contractor shall be responsible for the repair and resodding of all eroded or bare spots until project acceptance and during the warranty period. Repair sodding shall be accomplished as in the original work except that fertilizing may be omitted. Sufficient watering shall be done by the Contractor to maintain adequate moisture for optimum development of the lawn areas. Sodded areas shall receive no less than 1.5 inches of water per week. The Contractor shall also mow lawn areas once per week until final completion of the Project.

### 3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS

- A. Lawn areas planted under this Contract and lawn areas outside the designated areas damaged by Contractor's operations shall be repaired at once by proper sod bed preparation, fertilizing and resodding, in accordance with these Specifications.

END OF SECTION

## SECTION 03200

### CONCRETE REINFORCING

#### PART 1 - GENERAL

##### 1.1 REFERENCE:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 3 Specification Sections, apply to this Section.

##### 1.2 WORK INCLUDES:

- A. Provide concrete, concrete masonry unit and precast concrete reinforcement as shown on the drawings, required by these specifications or necessary for proper completion of the work.

##### 1.3 SUBMITTALS:

- A. Shop drawings showing all bar sizes, supports, fabrication dimensions and location for placing of the reinforcing in accordance with the General Conditions of the Contractor for construction shall be submitted for approval. Approval shall be obtained prior to fabrication.
- B. Comply with the ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, diagrams of bent bars, and arrangements of concrete reinforcement.

##### 1.4 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with the provisions of the most recent edition of the following codes, specifications and standards, except as otherwise shown or specified.
  - 1. ACI 301 - Guidelines for Structural Concrete for Building.
  - 2. ACI 315 - Details and Detailing of Concrete Reinforcement.
  - 3. ANSI/ASTM A83 - Cold Drawn Steel Wire for Concrete Reinforcement.
  - 4. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
  - 5. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
  - 6. ANSI/AWS D1.4 - Structural Welding Code Reinforcing Steel.
  - 7. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  - 8. ASTM A616 - Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
  - 9. ASTM A617 - Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
  - 10. CRSI - Manual of Practice.

11. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
12. CRSI 65 - Recommended Practice for Placing Bar Supports, Guidelines and Nomenclature.
13. No foreign steel shall be used.

## PART 2 - PRODUCTS

### 2.1 MATERIAL:

- A. Reinforcing Bars shall be rolled from new billet steel, Grade 60 and deformed in accordance with ASTM A615, for bars numbers 3 to number 18.
- B. Welded wire fabric shall be ASTM A185, welded steel wire fabric. The yield strength of the steel wire shall not be less than 60,000 pounds per square inch and shall be epoxy coated conforming to ASTM A776 81.
- C. Bar Supports and Spacers
  1. For unexposed concrete, bar supports and spacers shall be manufactured of standard brights basic wire upturned legs.
  2. For concrete which will be exposed to view from the underside upon completion of the structures, use plastic capped bar supports and spacers.
  3. For slabs on grade, use bolsters with runners where base will not support chair legs.
  4. Do not use wood, brick or other non-specified material.
- D. Tie wire: Federal specifications QQ-W-461 Annealed Steel, 16 ga. galvanized minimum.
- E. Welded electrodes: AWS A5.1, Low Hydrogen, E70 Series.
- F. Welded Inserts: Provide wedge inserts for the support of brick ledger angles. Wedge inserts shall be placed at 4'-0" o.c. unless drawings indicate a more restrictive spacing. Provide the F-7 wedge insert and 3/4" diameter askew bolt, nut and washers as manufactured by Dayton Superior, 10101 C General Drive, Orlando, Florida, or equal.

Wedge inserts and 3/4" diameter bolts to be deemed equal shall submit test information documenting an ultimate capacity of at least 8,500 pounds when the shelf angle is loaded 2-1/4" from the face of concrete, with the bottom of the insert 1-1/2" clear from the beam bottom, for concrete strength of 5,000 psi.

## PART 3 - EXECUTION

### 3.1 GENERAL:

- A. Cleaning and storage reinforcement: Steel reinforcement at the time concrete is placed shall be free from heavy rust, scale or other coating that will destroy or reduce the bond.
- B. All reinforcing steel shall be stored in neat piles at the site clear of the ground in such a manner that all bars can be readily identified when required.



- C. Excessive form oil on the reinforcing shall be removed by washing the reinforcing with kerosene. Exercise due care that no smoking or welding is permitted in the area of cleaning. Provide fire extinguisher at cleaning site.
- D. Supports for reinforcing steel: All reinforcing steel shall be rigidly supported, accurately located and held in position by the use of proper reinforcing steel supports, spacers and accessories before the concrete placement begins.
- E. The legs of all reinforcing supports shall be bent to form a foot so that the side and not the end of leg rods bears on the form.
- F. Metal reinforcement shall be protected by the thickness of the concrete indicated on the drawings.
- G. Do not use bar supports or reinforcing as support for concrete runways or construction loads.
- H. Placing tolerances: Clear distance to formed surfaces:  $\pm 1/4$  inch. Minimum spacing between bars:  $-1/4$  inch:
  - 1. Top Bars in Slabs or Beams:
    - Members 8" or less in depth:  $\pm 1/4$  inch
    - Members 8" to 24" in depth:  $\pm 1/4$  inch
    - Members 24" or greater in depth:  $\pm 1/2$  inch
  - 2. Crosswire of Slabs or Beams: Spaced evenly within 2 inches.
  - 3. Lengthwise of Member:  $\pm 2$  inches
- I. Bending details: Typical bending and placing diagrams are shown on the drawings. For parts not shown, bending details and lengths shall conform to the requirements of the ACI Building Code 318 and "Manual of Standard Practice for Detailing Reinforced Concrete Structures" ACI 315.
- J. Bends for stirrups and ties shall be made around a pin having the diameter no less than 1-1/2 inches for number 3, and 2 inches for number 4.
- K. Bends for other bars shall be made around a pin having a diameter not less than six bar diameters for number 3 to number 6, 8 bar diameters for number 9, number 10 and number 11, 10 bar diameters for number 14 and number 18.
- L. All bars shall be bent cold. Heating of bars will not be allowed.

### 3.2 SPECIAL REINFORCING REQUIREMENTS:

- A. Where walls or other items are shown as built integrally with other section, but are placed as separate pours, key and dowels must be provided. Dowels shall be the same size and at the same spacing as reinforcing.
- B. Main reinforcing bars shall not be spliced unless so noted on the drawings or approved by the Architect/Engineer.
- C. Provide electrically welded wire fabric, ASTM A-185 reinforcing in all concrete slabs on ground unless shown otherwise. Sizing to be in accordance with those shown on the drawings.

- D. Provide corner bars of same size and spacing as main reinforcement at all intersections and corners.
- E. Where openings occur in walls, or slabs, provide two number 5 bars at all sides and extending at least two feet beyond the corners and two number 5 bars at least three feet long diagonally across each re-entrant corner.
- F. Unless permitted by an Inspector employed by the Owner reinforcement shall not be bent after being embedded in hardened concrete.

### 3.3 INSPECTION OF REINFORCEMENT:

- A. Reinforcing placement must be checked by an Inspector employed by the Owner before any concrete is placed. Any corrections shall be made before concrete is placed.
- B. Placement of reinforcing shall occur in such sequence that the Inspector has sufficient time to inspect the correctness of the reinforcing within the placement area and retains the right to require necessary revisions be made before concrete is placed.
- C. The Contractor shall notify the Inspector at least 24 hours in advance of concrete placement for a particular portion of the structure.
- D. Galvanized wire ties of double loop and tightly fastened to secure the proper spacing of rods and ties are required.

### 3.4 LAP SPLICING:

- A. Welded wire fabric shall be overlapped wherever successive mats or rolls are continuous such that the overlap measured between outermost cross wires is not less than one wire spacing plus 2 inches.
- B. Longitudinal (continuous) footing reinforcing: Class B.
- C. Beam Reinforcing: Class B.
- D. Column Reinforcing: Class B Offset lap splices.
- E. Column/footing dowels: Class B
- F. Masonry vertical reinforcing: Class B.
- G. Splices not included above: Class B.

END OF SECTION

## SECTION 03300

### CAST IN PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.1 REFERENCE:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 3 Specification Sections, apply to this Section.

##### 1.2 WORK INCLUDES:

- A. All labor and materials required for cast-in-place concrete shown on the drawings or specified herein. Concrete bases and pads for mechanical and electrical equipment, coordinate with respective disciplines. Concrete for grouting of concrete unit masonry.

##### 1.3 QUALITY ASSURANCE:

###### A. Codes and Standards

1. Comply with the provisions of the most recent edition of the following codes, specifications and standards, except as otherwise shown or specified.
  - a. ACI 318 "Building Code Requirements for Reinforced Concrete."
  - b. ACI 301 "Specifications for Structural Concrete for Buildings."
  - c. ACI 302 "Recommended Practice for Concrete Floor or Slab Construction."
  - d. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."
  - e. ACI 305 "Recommended Practice for Hot Weather Concreting."
  - f. ACI 307 "Recommended Practice for Cold Weather Concreting."
  - g. ACI 309 "Recommended Practice for Consolidation of Concrete."
  - h. CRSI Manual of Standard Practice
  - i. CRSI Placing Reinforcing Bars
  - j. ASTM C31 "Making and Curing Concrete Compression and Flexure Strength Test Specimens in Field."
  - k. ASTM C33 "Concrete Aggregates"
  - l. ASTM C39 "Compressive Strength of Molded Concrete Cylinders."
  - m. ASTM C42 "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete."
  - n. ASTM C94 "Ready-Mixed Concrete"
  - o. ASTM C143 "Slump of Portland Cement Concrete."
  - p. ASTM C150 "Portland Cement."
  - q. ASTM C172 "Sampling Fresh Concrete"

##### 1.4 QUALITY CONTROL:

- A. Do not commence placement of concrete until mix designs have been approved by the Engineer. Any concrete work which does not conform to the specified requirements, including strength, tolerance and finishes shall be corrected by the Contractor at his expense and as directed by the Engineer.

##### 1.5 DIMENSIONAL TOLERANCE FOR FORMED SURFACES:

- A. Variation from plumb:

1. In the lines and surfaces of columns, piers, walls and in arises:
    - a. In any 10 ft. of length: 1/4 in.
  2. Exposed corner columns, control-joint grooves, and other conspicuous lines:
    - a. In any 20 ft. of length: 1/4 in.
- B. Variation from the level or from the grades specified in the contract documents:
1. In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores:
    - a. In any 10 ft. of length: 1/4 in.
  2. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
    - a. In any bay or in 20 ft. length: 1/4 in.
- C. Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions:
1. In any bay: 1/4 in.
- D. Variation in the sizes and location of sleeves, floor openings, and wall openings: +1/4 in.
- E. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:  $\pm 1/4$  in.
- F. Footings
1. Variations in dimensions in plan:  $\pm 1/4$  in.
  2. Misplacement or eccentricity: Percent of the footing width in the direction of misplacement but not more than 2.0 in.
  3. Thickness:
    - a. Decrease in specified thickness: 5%
    - b. Increase in specified thickness: No limit
- G. Variation in steps:
1. In a flight of stairs:
    - a. Rise: +1/8 in.
    - b. Tread: +1/8 in.
  2. In consecutive steps:
    - a. Rise: +1/8 in.
    - b. Tread: +1/8 in.
- H. NOTE: Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

## 1.6 SUBMITTALS:

- A. Concrete Mix Report
1. For each proposed concrete mix, submit two copies of the test report mix. Submit report at least 15 days prior to start of concrete pouring.
- B. Material Certificates
1. Provide material certificates signed by material manufacturer certifying that each material complies with the specified requirements.
- C. Test Reports
1. Submit results of all compression, slump and air content tests performed during mix design and throughout the duration of the project as required by the Specifications.
  2. Submit sieve analysis of coarse and fine aggregate intended for use in the project.
  3. Submit a copy of State Certification that the concrete batching and weighing equipment

- has been inspected and approved.
4. Submit letters from the cement and aggregate suppliers certifying that furnished material meet appropriate ASTM standards.

1.7 TESTING:

- A. Concrete shall be sampled and tested for Quality Control during placement of concrete.
- B. Failure to detect defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate Engineer for final acceptance.
- C. Required Sampling and Testing
  1. Samples for strength tests of each concrete mix shall be taken no less than once a day or no less than once for each 50 cu. yd. of concrete.
  2. If the total volume of concrete is such that the frequency of testing required above would provide less than five strength tests for a given mix, tests shall be made from at least five randomly selected batches.
  3. Secure composite samples in accordance with ASTM C172.
  4. Mold and cure five specimens from each sample in accordance with ASTM C31.
  5. Samples for test shall be taken at the 1/4 and 3/4 points of the load mixer.
  6. Cure specimens under laboratory conditions except as follows:
    - i. When in the opinion of the Engineer there is a possibility of the surrounding air temperature falling below 40°F he may require additional specimens to be cured under job conditions.
    - ii. In hot weather periods or periods of low humidity the Engineer may require additional specimens to be cured under job conditions.
  7. Test specimens in accordance with ASTM C39.
    - i. Test one specimen at 3 days.
    - ii. Test one specimen at 7 days.
    - iii. Test two specimens at 28 days for acceptance. This test of two specimens constitutes one strength test. The results of the strength test shall be the average of the strengths of the two specimens tested.
    - iv. Hold one specimen for future use if test does not comply at 28 days.
    - v. Determine slump of the concrete sample for each strength test and whenever consistency appears to vary using ASTM C143.
    - vi. Determine air content for each strength test in accordance with either ASTM C231, ASTM C173, or ASTM C138.
    - vii. Determine temperature of concrete sample for each strength test.
- D. Evaluation of Test Results
  1. For evaluation each specified concrete mix shall be represented by at least five strength tests.
- E. The strength level of the concrete will be considered satisfactory if both of the following requirements are met.
  1. The average of all sets of three consecutive strength tests (average of two cylinders) exceeds specified strength.
  2. No individual strength test (average of two cylinders) falls below the specified strength by 500 psi.
- F. If the strength level does not meet the above requirements, the Engineer shall consider the concrete to be deficient and shall have the right to reject the work or require load tests on the structure in the areas the tests represent at no cost to the Owner.
- G. Report tests results in writing to the Engineer and the Contractor on the same day that tests are

made. Reports of compressive strength tests shall contain:

1. Project identification name and number.
2. Date of concrete placement
3. Name of Contractor.
4. Name of Concrete Supplier and Truck Number.
5. Name of Concrete Testing Service.
6. Concrete type and class.
7. Location of concrete batch in the structure.
8. Design compressive strength at 28 days.
9. Slump.
10. Air Content.
11. Concrete temperature.
12. Concrete mix identification number.
13. Compressive breaking strength.
14. Type of break for both 7-day tests and 28-day tests.

#### 1.8 TESTING SERVICES:

- A. The Contractor will employ an independent testing laboratory meeting the requirements of ASTM E329 and approved by the Engineer to perform the following services:
  1. Sample concrete at placement and make slump, air content, temperature and compression tests as described above.
  2. Report test results to the Engineer.
- B. Contractor Responsibilities
  1. Pay for additional testing and inspection of materials or concrete occasioned by their failure by test of inspection to meet specification requirements.
  2. Provide the necessary testing services for the qualification of proposed materials and the establishment of mix designs, and for any other testing services required by the Contractor.
  3. Furnish any necessary labor to assist the designated testing agency in obtaining and handling samples.
  4. Advise the testing agency sufficiently in advance of operations to allow for completion of tests.
  5. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens as required by ASTM C31.
  6. The use of Testing Services shall in no way relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

### PART 2 - PRODUCTS

#### 2.1 MATERIAL:

- A. Portland Cement
  1. ASTM C150, Type I (for minor, non-structural elements) and Type II.
- B. Aggregate
  1. ASTM C33 and as herein specified.
    - i. Provide aggregates from a single source for all exposed concrete.
  2. Fine Aggregate: Clean, sharp natural sand free from loam, clay, lumps or other deleterious substance.
  3. Coarse Aggregate: For Normal Weight Concrete: Comply with ASTM C33 size #57. Clean, uncoated, processed aggregate of crushed stone or washed gravel containing no clay, mud, loam or foreign matter. Use of pit or bank run gravel is not permitted. Aggregate shall meet ASTM C33 Size No. 56 or 57.

- i. Where the Contractor elects to place concrete by pumping he shall provide a pump with sufficient capacity to place this size of aggregate.
- C. Water:
  - 1. Water shall be fresh and potable. Water shall be obtained from city water system. The Contractor shall pay for the quantity of water used during construction and also furnish, install and maintain a water meter if required by the Water Department.
- D. Air-Entraining Admixtures – ASTM C260
  - 1. “Darex” by Grace
  - 2. “SikaAer” by Sika Chemical Co.
  - 3. “MB-AE” by BASF
  - 4. “Air-Mix” by Euclid
- E. Water Reducing Admixture – ASTM C494 Type A
  - 1. “MasterSet R 300” by BASF
  - 2. “WRDA/HYCOL” by Grace
  - 3. “Plastocrete 161” by Sika
  - 4. “Eucon WR-75” by Euclid
- F. High Range Water Reducing Admixture (Superplasticizer) – Admixtures shall meet the requirements of ASTM C494 Type F and shall contain no chloride ions.
  - 1. Acceptable products:
    - i. “WRDA 19” by W.R. Grace
    - ii. “Sikament” by Sika
  - 2. Dosage and use of any mix containing this admixture shall be in strict accordance with the manufacturer’s direction and only with the written permission of the Engineer.
  - 3. A representative of the admixture manufacturer shall be present to observe the products use and to assure that it is being used in accordance with the manufacturer’s directions.
- G. Water Reducing/Retarding Admixture – Shall comply with ASTM C494 Type D.
  - 1. Acceptable products:
    - i. “Daratard 17” by W.R. Grace
    - ii. “Masterset R 100” by BASF
    - iii. “Plastocrete 161” by Sika
- H. Calcium Chloride – Do not use calcium chloride in any concrete.
- I. Concrete Color Admixtures
  - 1. “Colorcrete” by Euclid
  - 2. “Liquid Integral Color” by Euclid
  - 3. Integral Colors by Huntsman (Formerly Davis Colors)
  - 4. “Chromix” by L.M. Scofield d.b.a. Sika
- J. Integral Concrete Waterproofing – Shall be Anti-Hydro by Anti-Hydro Company or approved equal.
- K. Shrinkage Reducing Admixture – Shall be Conex by Euclid Chemical. Dosage of 4% by weight of cementitious as noted on plan

## PART 3 - RELATED MATERIALS

### 3.1 VAPOR BARRIER:

- A. Refer to Specification Section 031000.

### 3.2.1 PERFORMED JOINT FILLERS:

- A. Provide preformed strips, non-staining, non-extruding and resilient bituminous type complying with ASTM D1751.B. Thickness to be as indicated on drawings. If no thickness is indicated use 1/2".

### 3.3 WATERPROOF SHEET FOR CURING:

- A. Conform to ASTM C171.
- B. Polyethylene film thickness shall be at least 4 mils.

### 3.4 MEMBRANE CURING COMPOUND:

- A. Refer to Division 03 Section "Concrete Finishes."

### 3.5 CURING/SEALING COMPOUND:

- A. Refer to Division 03 Section "Concrete Finishes."

### 3.6 BONDING AGENT (EPOXY TYPE) ASTM C881:

- A. "Sikadur Hi-Mod" by Sika
- B. "Thiopoxy" by Grace
- C. "Epoxy #452" by Euclid

### 3.7 NON-SHRINK, NON-METALLIC GROUT:

- A. "Five Star Grout" by Five Star
- B. "NS Grout" by Euclid
- C. "MasterFlow 713" by BASF

## PART 4 - EXECUTION

### 4.1. GENERAL

#### A. Proportioning

1. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with the latest edition of ACI 211.1.
2. Contractor shall provide all testing services for approval of mixes.
3. The Contractor shall furnish the Engineer for approval a mix design for each class of concrete at least 15 days prior to start of work.

#### B. Report to Include

1. Total weight of water, cement, coarse aggregate fine aggregate and admixtures to be used.

#### C. Slump.



- D. Percent of Air.
  - 1. Results of Compression Test for 6 cylinders cast and broken 7, 14 and 28 days.
  - 2. Grain size curves for both aggregates.
- E. Do not begin production until mixes have been approved by Engineer.
- F. When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301-72. Strength data for establishing standard deviation will be considered suitable if the concrete production facility has certified records consisting of at least 30 consecutive tests in one group or the statistical average for 2 groups totaling 30 or more tests, representing similar materials and project conditions.
- G. The proper proportions of cement, aggregate and water to obtain the required strength shall be determined from ACI 211.1 "Recommended Practice for Selection Proportions for Normal and Heavy Weight Concrete".
  - 1. Strength requirements shall be as shown on the structural drawings.
  - 2. In all cases, not more than 6 gallons of water per each sack of cement will be allowed.
  - 3. Unit weight for normal weight concrete shall be 150 pcf + 5%.
  - 4. Air content for mixes requiring air entrainment shall be 3.5% + 1.5%.
  - 5. Slump at the point of placement shall be not less than 4" and not more than 6".
  - 6. Water/cement ratio not to exceed 0.45 by weight.
- H. Concrete containing a high range water-reducing admixture (superplasticizer) shall have an initial slump or 1-1/2 to 2 inches and a final slump not to exceed 8 inches after addition of the admixture.
- I. Mix design adjustments may be requested by the Contractor when characteristics of material, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as approved by the Engineer. Laboratory test data for revised mix and designs and strength results must be submitted to and accepted by the Engineer before using it in the work.
- J. Ready-Mix Concrete shall be mixed and delivered in accordance with ASTM C94, "Specifications for Ready-Mix Concrete" and shall meet other applicable requirements of this Section.

#### 4.2 AIR-ENTRAINING ADMIXTURE:

- A. Add air-entraining admixture in accordance with manufacturer's recommendations.

#### 4.3 WATER REDUCING ADMIXTURE

- A. Use water-reducing admixtures in all concrete and in strict compliance with the manufacturer's directions.

- B. Admixture to increase cement dispersion, or provide increased workability for low-slump concrete, any be used at the Contractor's option subject to the Engineer's acceptance.
- C. The reduced water content shall be taken into account when proportioning mixes.

#### 4.4 SHRINKAGE COMPENSATING ADMIXTURE

- A. Shrinkage compensating concrete shall have 6% dose by weight of Euclid CONEX additive.

#### 4.5 MIXING

- A. Unless otherwise approved by the Engineer use ready mix concrete conforming to ASTM C494.
- B. Place concrete no more than 90 minutes after initial mixing.
- C. Tempering: All concrete shall be placed within 1-1/2 hours after introduction of water to the mix. Under no conditions may additional water be added that will exceed the quantity of water called for in the design mix. Submit time stamped batching tickets on delivery of concrete to job site. All concrete where the quantity of water has exceeded the design mix will be removed and replaced with proper concrete at no cost to the Owner.
- D. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.
  - 1. When the air temperature is between 85 degrees Fahrenheit and 90 degrees Fahrenheit reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is over 90 degrees Fahrenheit, reduce the mixing and delivery time to 60 minutes.

#### 4.6 PLACING CONCRETE

##### A. Pre-Placement Inspection

- 1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts and contractors to permit the installation of their work; cooperate with other trades in setting such work, as required.
- 2. The Contractor shall notify the Inspector at least 24 hours in advance of concrete placement for a particular portion of the building. Placement of reinforcing shall occur in such sequence that the Inspector has sufficient time to inspect the correctness of the reinforcing within placement area & retains the right to require necessary revisions be made before concrete is placed.

##### B. Placement

- 1. Clean out all chips, saw dust, dirt and other foreign matter from forms and assure that inside of forms are free of frost. Remove any dirt, debris, and water from trenches and other excavations. Remove any dirt, debris and mud from tops of footings or pile caps before pouring walls.
- 2. Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints.

3. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified.
4. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.
5. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding or tamping. Use vibrators designed to operate with vibratory element submerged in concrete.
6. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Do not insert vibrators into lower layers of concrete that have begun to set. Limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
7. Dropping the concrete a distance of more than 6 feet or depositing a large quantity at any point and running or working it along the forms will not be permitted. An "elephant trunk" shall be used for all wall pours, which are over 6 feet high.

C. Cold Weather Placing

1. Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
2. When air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55 degrees Fahrenheit, and not more than 80 degrees Fahrenheit at point of placement.
3. Do not use frozen material or material containing ice or snow.
4. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
5. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators.

D. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees Fahrenheit. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature, provided the water equivalent of the ice is calculated to the total amount of mixing water.
3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperatures immediately before embedment in concrete.

4. Wet forms thoroughly before placing concrete.
5. Do not use retarding admixtures without the written approval of the Engineer.
6. Place concrete in column forms before beam and slab steel is in place. Place column concrete in not more than 36 inch lifts before vibrating.
7. Slabs and Beams: Thoroughly clean beam and slab forms after placing column concrete. Do not place concrete in roof or wall beams or slabs until concrete in columns have been in place at least 4 hours. Place concrete for slabs and beams continuously in layers not over 12 inches deep. Arrange the work so that the joints will be located at points indicated.
8. Place slabs on fill carefully to avoid damage to vapor barrier.

E.      Compaction

1. Compact concrete in layers by internal vibrating equipment, supplemented by hand rodding and tamping as required. Do not use vibrators to move the concrete laterally inside the forms.
2. Internal vibrators should maintain a speed of at least 5,000 impulses per minute when submerged in concrete (at least one spare vibrator in working condition should be maintained at the site at all times).
3. Limit duration of vibration to the time necessary to produce satisfactory consolidation without causing segregation, but in no case more than 15 seconds per square foot of exposed surface. Move vibrator constantly and place in each specific spot only once.

F.      Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
2. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Bring slab surfaces to the correct level with a straight-edge and strike-off. Use bull floats and darbies to smooth the surface, leaving it free of humps or hollows.
4. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.
5. Concrete to be placed on grade shall be placed over 15-mil polyethylene film.
  - a. This film shall be laid continuously and in as large of pieces as possible.
  - b. Any holes or perforations caused by pipes, conduits, ducts and general construction activity shall be securely taped to make the film vapor tight.
6. Floor slabs shall be level or pitched to drains as required.
7. All top of slab elevations shall be determined by the use of preset runners supported at the proper elevation.

G.      Joints

1. Construction Joints

- a. Construction joints not shown on the drawings shall be located so as not to impair the strength and appearance of the structure, and at locations approved by the Engineer.
- b. Provide keyways at least 1-1/2 inches deep in all construction joints in walls and slabs. Accepted bulkheads designed for this purpose may be used in slabs
- c. Place construction joints perpendicular to main reinforcement.
- d. Roughened construction joints where indicated on the drawings shall be clean, free of laitance and intentionally roughened to a full amplitude of 1/4 inch by raking. Remove laitance entirely by high pressure water blasting.
- e. Continue all reinforcement across construction joints. Welded wire fabric in slabs on grade may stop at those joints, which are shown on the drawings.

2. Isolation Joints in Slabs-on-Grade

- a. Locate where indicated or detailed on Drawings to points of contact between the slabs on ground and vertical surfaces, such as foundations, curbs, etc.
- b. Install preformed joint filler according to manufacturer's recommendations. Filler shall be closely fitted to wall faces and to slab edges.
- c. Reinforcement shall not extend through isolation joints.

3. Weakened-Plane (Control) Joints

- a. Locate where required and as indicated on the drawings.
- b. Form weakened-plane joints in fresh concrete by grooving top portion with a recommended jointing tool and finishing edges with an edger.
- c. If joints are saw-cut cutting shall be started as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw; and cutting shall be completed before shrinkage stresses become sufficient to project cracking.
- d. Form or cut joints to a depth of 1/3 of slab or wall thickness.

H. Expansion Joints

- 1. Locate as shown on drawings.
- 2. Joints in on-grade walkways maximum at 20 feet o.c., at every change in thickness, direction and at center line of drives. Score and tool between expansion joints in equal bays at not over 5 feet o.c.
- 3. Joints shall be straight and smooth. They shall have hardened before fresh

concrete is deposited against them.

I. Other Embedded Items

1. All sleeves, inserts, anchors, and embedded items required for adjoining work shall be placed prior to concreting.
2. All Contractors whose work is related to the concrete or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.

4.7 FINISHES

Refer to Division 03 Section "Concrete Finishes."

4.8 CONCRETE CURING AND PROTECTION

Refer to Division 03 Section "Concrete Finishes."

4.9 FLOOR HARDENER

- A. Those areas noted to receive floor hardener shall be treated with materials as specified and in accordance with manufacturer's directions.
- B. Concrete shall be cured using waterproof sheet material or continuously wet burlap as described above. No curing or sealing compound may be applied to areas to receive hardener.

4.10 PATCHING CONCRETE

- A. Any concrete work not formed as shown on the drawings or which for any reason is out of alignment or level, or shows defective surfaces, shall be considered as not conforming with the intent of the specifications and shall be removed unless the Engineer grant permission to patch a defective area.
- B. Immediately after removing the forms, all concrete surfaces shall be inspected. Any pockets showing unsolidified materials, or any other defective areas permitted by the Engineer to be patched, and all holes and honeycombed areas shall be patched before the concrete is thoroughly dry. The patching shall be made of the same material and of the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and white cement shall be substituted for a part of the dry Portland cement to match color of surrounding concrete. A patch repair mortar such as Sika Sikaquick 2500 may be used. Contractor is required to demonstrate the methods and materials to be used to fill voids to ensure water tightness.
- C. The mortar shall be thoroughly compacted into place and screened off so as to leave the patch slightly higher than the surrounding surface. It shall be left undisturbed for a period of one to two hours to permit shrinkage before being finally finished. Patches shall be finished in such a manner and texture as to match the adjoining surface.
- D. Patches shall be bonded with a re-wetable bonding agent.

4.11 EPOXY MORTAR REPAIR

- A. The areas to be patched shall have all loose, unsound concrete removed and then cleaned by sandblasting, vacuumed and/or blown clean with oil-free compressed air. The sound

concrete remaining shall then be scrubbed with the epoxy binder only (without aggregate) just prior to the placement of the epoxy mortar.

- B. The epoxy mortar shall be mixed and placed in accordance with the manufacturer's printed instructions. Such instructions shall be supplied to the Contractor by the supplier of the epoxy system.
- B. Do not apply mortar in layers greater than 1" thick. Maximum thickness for outdoor applications is 1/2".

#### 4.12 EPOXY GROUTING OF BOLTS AND REINFORCING BARS

- A. Drill holes in concrete 1/4" larger than the diameter of the bolt or bar and to the depth required. Holes to be blown free of dust and to be dry prior to placing epoxy grout.
- B. Use epoxy grout in accordance with these specifications and the manufacturers directions.
- C. Fill hole 1/3 with epoxy grout, insert bolt or bar and move up and down several times while filling hole.
- D. No load shall be applied to the bar or bolt for at least 24 hours.

#### 4.13 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in place construction. Provide other miscellaneous concrete filling shown or required to complete the work. Contractor is required to demonstrate the methods and materials to be used to fill voids to ensure water tightness.
- B. Equipment Bases and Foundation: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment with a template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing machines and equipment.

END OF SECTION

## SECTION 05140

### STRUCTURAL ALUMINUM

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Extent of structural aluminum work as shown on Drawings, including Schedules, Notes, and Details.
- B. Source Quality Control: Materials and fabrication procedures are subject to inspection and tests conducted by a qualified inspection agency in mill shop and field. Such inspections and tests will not relieve CONTRACTOR of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
- C. Details shown are typical; similar details apply to similar conditions unless otherwise indicated. Verify dimensions at Site whenever possible without causing delay in Work.
- D. Connections which are not designed shall be detailed such that the minimum connection capacity is equal to or greater than 1/2 the member capacity.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01040, Project Coordination, covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Submit manufacturer's specifications and installation instructions.
  - 2. Submit Shop Drawings prepared under supervision of a registered Professional Engineer, including complete details and schedules for fabrication and assembly of structural members, procedures, and diagrams. Include details of cuts, connections, camber, holes, welds, and other pertinent data.
  - 3. Provide setting Drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as Work of this Section.

##### 1.03 QUALITY ASSURANCE

- A. Codes and Specifications:
  - 1. Aluminum Association (AA), "Specifications for Aluminum Structures."
  - 2. ASTM B 221, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
  - 3. ASTM B 483, Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.



4. American Welding Society (AWS) D1.0, "Code for Arc and Gas Welding."
- B. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."
  1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
  2. If recertification of welders is required, retesting shall be CONTRACTOR's responsibility.
  3. Parts shall be welded with an inert gas shielded arc or resistant welding process. No welding process that requires a welding flux shall be used.

#### 1.04 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials to Site at such intervals to ensure uninterrupted progress of Work.
  1. Deliver anchor bolts and anchorage devices, which are embedded in cast-in-place concrete, in ample time not to delay work.
- B. Store materials to permit easy access for inspection and identification. Do not store materials in such a manner that would cause distortion or damage.

### PART 2 - MATERIALS

#### 2.01 PRODUCTS

- A. Tubes and Shapes: Type 6061-T6.
- B. Aluminum Bolts: Type 7075-T73.
- C. Aluminum Nuts: Type 6061-T6.
- D. Embedded Anchors: ASTM A 307 hot-dip galvanized.
- E. Electrodes for Welding comply with AWS Code.

#### 2.02 FABRICATION

- A. Fabricate and assemble structural assemblies in shop to greatest extent possible. Mark and match-mark materials for field assembly.
- B. Welded Construction: Comply with AWS code for procedures, appearance, and quality. Weld continuously along the entire area of contact except where tack welding is indicated.

### PART 3 - ERECTION

### 3.01 GENERAL

- A. Employ a land surveyor for accurate erection of structural members. Check elevations of concrete bearing surfaces, and locations of anchor bolts and similar devices before erection Work proceeds, and report discrepancies to ENGINEER. Do not proceed with erection until corrections have been made.
- B. Temporary shoring and bracing shall be provided with sufficient strength to bear imposed loads and ensure stability.
- C. Field Assembly: Set structural frames accurately to lines and elevations indicated.
- D. Splice members only where indicated and accepted on Shop Drawings.
- E. Do not enlarge unfit holes by burning or by use of drift pins except in secondary members. Ream holes that must be enlarged to admit bolts.
- F. Aluminum surfaces in contact with concrete, grout or dissimilar metals will be protected with a coat of bituminous paint or other approved material.

END OF SECTION

## SECTION 05510

## MISCELLANEOUS METAL

## PART 1 GENERAL

## 1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

## 1.02 RELATED WORK

- A. Pipe hangers and sleeves are included in Division 15.
- B. Equipment anchor bolts are included in the respective Sections of Division 15.

## 1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:
  - 1. Shop drawings, showing sizes of members, method of assembly, anchorage and connection to other members.
- B. Samples
  - 1. Submit samples as requested by the Engineer during the course of construction.
- C. Design Data
  - 1. Submit manufacturer's load and deflection tables for grating.
- D. Test Reports
  - 1. Certified copy of mill test reports on each aluminum proposed for use showing the physical properties and chemical analysis.
- E. Certificates
  - 1. Certify that welders have been qualified under AWS, within the previous 12 months, to perform the welds required under this Section.

## 1.04 REFERENCE STANDARDS

- A. Aluminum Association (AA)

1. AA M31C22A41
  - a. M31: Mechanical Finish, Fine Satin
  - b. C22: Finish, Medium Matte
  - c. A41: Clear Anodic Coating, Class I

B. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A48 - Standard Specification for Gray Iron Castings.
3. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
4. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.
5. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
6. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
7. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength.
10. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
11. ASTM A366 - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. ASTM A536 - Standard Specification for Ductile Iron Castings.
15. ASTM A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

16. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  17. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
  18. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
- C. American Iron and Steel Institute (AISI).
1. Specification for Structural Steel Buildings.
- D. American Welding Society (AWS)
1. AWS D1.1 - Structural Welding Code Steel.
  2. AWS D1.2 - Structural Welding Code Aluminum.
- E. Federal Specifications
1. FS-FF-B-575C - Bolts, Hexagonal and Square
- F. Occupational Safety and Health Administration (OSHA)
- G. 2010 Florida Building Code. (FBC)
- H. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
- 1.05 QUALITY ASSURANCE
- A. The work of this Section shall be completely coordinated with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.
  - B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.
  - C. All welding shall be performed by qualified welders and shall conform to the applicable AWS welding code. Welding of steel shall conform to AWS D1.1 and welding of aluminum shall conform to AWS D1.2.
- 1.06 DELIVERY, STORAGE AND HANDLING
- A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

- B. Repair items which have become damage or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

#### 1.07 PROJECT/SITE REQUIREMENTS

- A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

### PART 2 PRODUCTS

#### 2.01 GENERAL

- A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

#### 2.02 MATERIALS

- A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:
  - 1. Structural Steel ASTM A36
  - 2. Structural Steel Tubing ASTM A500, Grade B
  - 3. Welded and Seamless Steel Pipe ASTM A501 or ASTM A53, Type E or S, Grade B Schedule 40. Use standard malleable iron fittings, galvanized for exterior work
  - 4. Steel Sheets ASTM A366
  - 5. Gray Iron Castings ASTM A48, Class 35
  - 6. Ductile Iron Castings ASTM A536, Grade 65-45-12
  - 7. Aluminum Extruded Pipe ASTM B429, Alloy 6063 T6
  - 8. Aluminum Extruded Shapes ASTM B221, Alloy 6061 T6
  - 9. Aluminum Sheet and Plate ASTM B209, Alloy 6061 T6
  - 10. Stainless Steel Plates, Sheets, and Structural Shapes

- |   |  |
|---|--|
| a. Exterior, Submerged or Industrial Use        | ASTM A167, Type 316 (Type 316L for welded)                               |
| b. Interior and Architectural Use               | ASTM A167, Type 304  |
| 11. Stainless Steel Bolts, Nuts, and Washers    | ASTM A276, Type 316  |
| 12. Carbon Steel Bolts and Studs                | ASTM A307, Grade A (hot dip galvanized nuts and washers where noted)     |
| 13. High Strength Steel Bolts, Nuts and washers | ASTM A325 (mechanically galvanized per ASTM B695, Class 50, where noted) |
| a. Elevated Temperature Exposure                | Type I   |
| b. General Application                          | Type I or Type II  |
| 14. Galvanizing                                 | ASTM A123, Zn w/0.5 percent minimum Ni                                   |
| 15. Galvanizing, hardware                       | ASTM A153, Zn w/0.5 percent minimum Ni                                   |

## 2.03 ANCHORS, BOLTS AND FASTENING DEVICES

- A. Anchor bolt material shall be ASTM F593 unless otherwise noted.
- B. Unless otherwise noted, expansion anchors shall be zinc plated carbon steel wedge type anchors complete with nuts and washers. Type 316 stainless steel, wedge type anchors shall be used where they will be submerged or exposed to the weather or where stainless steel wedge type anchors are required. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwik-bolt III; ITW Ramset; Redhead trubolt, or equal.
- C. Compound masonry expansion anchors shall be lead expansion sleeve type anchors complete with nuts and washers. Anchors shall be precision die-cast zinc alloy with a minimum of two lead alloy expansion sleeves. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Star Expansion Industries, Star Slugin or equal.
- D. Adhesive capsule anchors shall be a two-part stud and capsule chemical resin anchoring system. Capsules shall contain premeasured amounts of polyester or vinyl ester resin, aggregate and a hardener contained in a separate vial within the capsule. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Adhesive capsule anchors shall be Hilti, HVA Adhesive Anchor; Molly, Parabond; Rawlplug, Rawl Chem-Stud or equal.
- E. Adhesive anchors, for fastening to hollow concrete block or brick, shall be a three-part stud, screen and chemical dispenser anchoring system. Adhesive cartridges shall contain premeasured amounts of resin and hardener which are mixed and deposited in a screen tube by a dispenser. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Anchors shall be Hilti HY 70 System or approved equal.
- F. Automatic end welded headed anchor studs shall be flux ended studs made from cold drawn steel, ASTM A108 Grades C-1010 through C-1020. Headed anchor studs shall be Nelson, H4L Headed Concrete Anchors or equal.
- G. Machine bolts and nuts shall conform to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.
- H. Toggle bolts shall be Hilti, Toggler Bolt or equal.



## 2.04 ACCESS HATCHES

- A. Access hatches shall have single or double leaf doors as indicated by the Drawings. The doors shall be 1/4-in aluminum diamond pattern plate with welded stiffeners, as necessary, to withstand a live load of 300 lbs/sq ft with a maximum deflection of 1/150th of the span. Hatches shall have a 1/4-in aluminum channel frame with a perimeter anchor flange or strap anchors for concrete embedment around the perimeter. Unless otherwise noted on the Drawings, use pivot torsion bars for counterbalance or spring operators for easy operation along with automatic door hold open. Hardware shall be durable and corrosion resistant with Type 316 stainless steel hardware used throughout. Provide removable lock handle. Finish shall be the factory mill finish for aluminum doors and frames with bituminous coating on the exterior of the frames in contact with concrete. Hatches shall be watertight and have a 1-1/2-in drainage coupling to the channel frame. Access hatches shall be Types as indicated on the Drawings by Bilco Company, New Haven, CT or equal.

## 2.05 MISCELLANEOUS ALUMINUM

- A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous aluminum items shall include: beams, angles, closure angles, hatches, floor plates, stop plates,, and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.
- D. Angle frames for hatches, beams, grates, etc, shall be complete with welded strap anchors attached.
- E. Aluminum diamond plate and floor plate shall have a minimum thickness of 3/8-in. Frames and supports shall be of aluminum construction. Fastening devices and hardware shall be Type 304 stainless steel. Plates shall have a mill finish.
- G. Miscellaneous aluminum items shall have a cleaned and degreased mill finish.

## 2.06 MISCELLANEOUS STEEL

- A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous steel items shall include: beams, angles, lintels, metal stairs, support brackets, base plates for other than structural steel or equipment, closure angles, bridge crane rails, monorail hoist beams, holddown straps and lugs, door frames, splice plates, subframing at roof openings and any other miscellaneous steel called for on the Drawings and not otherwise specified.
- D. Structural steel angle and channel door frames shall be shop coated with primer. Frames shall be fabricated with not less than three anchors on each jamb.
- E. Steel pipe pieces for sleeves, lifting attachments and other functions shall be Schedule 40 pipe unless otherwise shown on the Drawings. Wall and floor sleeves, of steel pipe, shall have welded circumferential steel waterstops at mid-length.
- F. Lintels, relief angles or other steel supporting masonry or embedded in masonry shall be shop coated with primer.
- G. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust and foreign matter and shall be given one shop coat of primer compatible with the finish coat after fabrication but before shipment. Paint shall be omitted within 3-in of proposed field welds. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces.
- H. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Coating shall be not less than 2 oz/sq ft of surface.

#### 2.07 MISCELLANEOUS STAINLESS STEEL

- A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

- B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous stainless steel items shall include: beams, angles, bar racks and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 3 and Division 4 respectively. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.
- B. Abrasions in the shop primer shall be touched up immediately after erection. Areas left unprimed for welding shall be painted with primer after welding.
- C. Zinc coating which has been burned by welding, abraded, or otherwise damaged shall be cleaned and repaired after installation. The damage area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.
- D. Specialty products shall be installed in accordance with the manufacturer's recommendations.
- E. Expansion bolts shall be checked for tightness a minimum of 24 hours after initial installation.
- F. Install adhesive capsule anchors using manufacture's recommended drive units and adapters and in compliance with the manufacturer's recommendations.
- G. Headed anchor studs shall be welded in accordance with manufacturer's recommendations.
- H. All steel surfaces that come into contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.
- I. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

- J. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.
- K. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

END OF SECTION

## SECTION 08330

### OVERHEAD COILING DOORS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Overhead coiling doors as indicated on Drawings and Schedules. Types of overhead coiling doors include the following:
  - 1. Insulated overhead doors.
  - 2. Motorized-operated doors.
- B. Provide complete motorized-operating door assemblies including door curtains, guides, counterbalance mechanism, hardware, operators, and installation accessories.
- C. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to Work of this Section.

##### 1.02 PERFORMANCE REQUIREMENTS

- A. Wind Loading: Design and reinforce overhead coiling doors to withstand a 45 pounds per square foot (180 mph) factored wind loading pressure unless otherwise indicated. Refer to Structural design criteria and components and cladding wind pressure schedule on Structural drawings for additional information.

##### 1.03 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product Data: Submit manufacturer's product data, electric operator wiring diagram, roughing-in diagrams, and installation instructions for each type and size of overhead coiling door.
    - a. Provide operating instructions and maintenance information, and complete information describing fire release system including electrical rough-in instructions.

##### 1.04 QUALITY ASSURANCE

- A. Provide each overhead coiling door as a complete unit produced by one manufacturer, including hardware, accessories, mounting, and installation components.

- B. Inserts and Anchorages: Provide inserts and anchoring devices which must be set in concrete or built into masonry for installation of units. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
- C. Provide Florida FL Product Approval Number on overhead door shop drawing submittal.

#### 1.05 WARRANTY

- A. Special Warranty: Submit a written warranty, executed by CONTRACTOR, Installer, and overhead door manufacturer, agreeing to repair or replace unit and components which fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to, structural failures including excessive deflection, excessive leakage or air infiltration, faulty operation of hardware and operator system, and deterioration of paint finish, metals, metal finishes, and other materials beyond normal weathering.
  - 1. Submit written warranty in accordance with Division 1: Warranties.
  - 2. Warranty period is 3 years or 20,000 cycles after date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Atlas Door Corp.
  - 2. The Cookson Co.
  - 3. Cornell Iron Works, Inc.
  - 4. Kinnear Division, Harsco Corp.
  - 5. Mahon Rolling Door Division, RCM Corp.
  - 6. North American Rolling Door, Inc.
  - 7. Overhead Door Corp. (Basis of Design)
  - 8. Wayne Dalton Commercial Doors.
  - 9. Windsor Door Division, The Ceco Corp.

#### 2.02 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats designed to withstand required wind loading, of continuous length for width of door without splices. Unless otherwise indicated, provide slats of material gauge recommended by door manufacturer for size and type of door required, and as follows:
  - 1. Steel Door Curtain Slats: Structural quality, cold-rolled galvanized steel sheets complying with ASTM A 446, Grade A, with zinc-rich premium powder coating system for caustic environments, complying with ASTM A 525, and phosphate treated before fabrication.

2. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane- foam type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectfully, according to ASTM E 84. Enclose insulation completely metal slat faces.
  3. Inside Curtain Face: To match material of outside metal curtain face.
- B. Endlocks: Galvanized metal castings galvanized after fabrication, secured to curtain slats with galvanized rivets. Provide locks on alternate curtain slats for curtain alignment and resistance against lateral movement.
  - C. Windlocks: Malleable iron castings secured to curtain slats with galvanized rivets. Unless otherwise recommended by door manufacturer, provide windlocks on doors exceeding 16 feet wide. Space windlocks approximately 24 inches o.c. on both edges of curtain.
  - D. Bottom Bar: Consisting of two angles, each not less than 1-inch by 1-inch by 1/8-inch-thick, galvanized or stainless steel or aluminum extrusions to suit type of curtain slats.
    1. Provide a replaceable gasket of flexible vinyl or neoprene between angles as a weather seal and cushion bumper for manually operated doors unless shown as an overlapping joint.
  - E. Curtain Jamb Guides: Fabricate curtain jamb guides of steel angles, or channels and angles with sufficient depth and strength to retain curtain loading. Build-up units with minimum 3/16-inch-thick steel sections, galvanized after fabrication. Slot bolt holes for track adjustment.
  - F. Secure continuous wall angle to wall framing by 3/8-inch minimum bolts at not more than 30 inches o.c., unless closer spacing recommended by door manufacturer. Extend wall angles above door opening head to support coil brackets, unless otherwise indicated. Place anchor bolts on exterior wall guides so they are concealed when door is in closed position. Provide removable stops on guides to prevent over-travel of curtain and continuous bar for holding windlocks.
  - G. Weather Seals: Provide neoprene weather stripping for exterior exposed doors, except where otherwise indicated. At door heads, use 1/8-inch thick continuous sheet secured to inside of curtain coil hood. At door jambs, use 1/8-inch thick continuous strip secured to exterior side of jamb guide.

## 2.03 COUNTERBALANCING MECHANISM

- A. Counterbalance doors by means of adjustable steel helical torsion spring, mounted around a steel shaft and mounted in a spring barrel and connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up of

curtain without distortion of slats and limit barrel deflection to not more than 0.03 inch per foot of span under full load.

1. Provide spring balance of one or more oil tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.
  2. Fabricate torsion rod for counterbalance shaft of case-hardened steel, of required size to hold fixed spring ends and carry torsional load.
- C. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bell mouth guide groove for curtain.
- D. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and any portion of between-jamb-mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.
1. Fabricate hoods for doors of not less than 24 gauge galvanized steel.

#### 2.04 PAINTING

- A. Shop clean and prime ferrous metal and galvanized surfaces, exposed and unexposed, except faying and lubricated surfaces, with door manufacturer's standard rust-inhibitive primer. Finish coating of door shall be factory applied manufacturer's premium finish (fusion bonded epoxy coating) for enhanced durability in caustic environments. Color as indicated on drawings, or, if not otherwise indicated, as selected by OWNER from manufacturers' full range of standard available colors.

#### 2.05 ELECTRIC DOOR OPERATORS

- A. Provide electric door operator assembly of size and capacity recommended, and provided by door manufacturer complete with electric motor and factory pre-wired motor controls, gear reduction unit, solenoid operated brake, remote control stations, control devices, conduit and wiring from controls to motor and central stations, and accessories required for proper operation.
- B. Provide hand-operated disconnect or a mechanism for automatically engaging a sprocket and chain operator and releasing brake for emergency manual operation. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- C. Design operator so that motor may be removed without disturbing limit switch adjustment and without affecting emergency auxiliary operator.



- D. Door Operator Type: Provide wall- or bracket-mounted door operator units consisting of electric motor, worm gear drive from motor to reduction gear box, chain or worm gear drive from reduction box to gear wheel mounted on counterbalance shaft, and a disconnect-release for emergency manual operation. Provide motor and drive assembly of horsepower and design as determined by door manufacturer for size of door required.
- E. Electric Motors: Provide high-starting torque, reversible constant duty, Class A insulated electric motors with overload protection, sized to move door in either direction from any position at not less than 2/3 foot or more than 1 foot per second.
  - 1. Coordinate voltage, wiring requirements, and current characteristics of motors with building electrical system. (See electrical Drawings for NEMA type area classifications.)
  - 2. Provide motor and controller with NEMA 4X enclosure.
- F. Automatic Closing: Provide automatic closing device and governor, operating when activated by temperature rise and melting of 160 degrees F (71 degrees C) fusible link. Construct governor unit to be inoperative during normal door operations. Design release mechanism for easy resetting.
  - 1. Provide manufacturer's standard UL labeled smoke detectors and electromechanical door holder release devices where indicated.
    - a. Fabricate unit to permit manual lifting of curtain for emergency exit after automatic closing with curtain returning to closed position when released.
- G. Remote Control Station: Provide momentary contact, 3-button control station with push-button controls labeled "Open," "Close," and "Stop."
  - 1. Provide interior units, full-guarded, surface-mounted heavy-duty explosion-proof NEMA Type 4X enclosure.
- H. Automatic Reversing Control: Provide each motorized door with automatic safety sensor extending full width of door opening. Activation with sensor will immediately stop downward travel and reverse direction to fully opened position.
  - 1. Pressure Sensor Edge: Provide each motorized door with an automatic safety sensor edge located within astragal or weather stripping mounted to bottom door rail. Contact with switch will immediately reverse downward door travel. Furnish manufacturer's standard take-up reel or self-coiling cable.
    - a. Provide electrically actuated automatic bottom bar.
  - 2. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
- I. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final Shop Drawings, manufacturer's instructions, and as specified in this Section.
- B. Upon completion of installation, including Work by other trades, lubricate, test, and adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

END OF SECTION

SECTION 09800  
PROTECTIVE COATING

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall provide protective coatings, complete and in place, in accordance with the Contract Documents.
- B. Definitions
  - 1. 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 pretreatment, primer, intermediate coat, or finish coat.
  - 2. The term "DFT" means minimum dry film thickness, without any negative tolerance.
- C. The following surfaces shall not be protective coated:
  - 1. Concrete, unless required by items on the concrete coating schedule below or the Drawings.
  - 2. Stainless steel
  - 3. Machined surfaces
  - 4. Grease fittings
  - 5. Glass
  - 6. Equipment nameplates
  - 7. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.
- D. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the Drawings are used to show or extend the limits of coating schedules, to show exceptions to the schedules, or to clarify or show details for application of the coating systems.
- E. Where protective coatings are to be performed by a lower tier contractor, the contractor shall possess a valid state license as required for performance of the painting and coating WORK called for in this specification.

## 1.02 EXISTING COATINGS/LININGS

- A. To maintain all warranties, manholes and wet wells that have an existing coating or lining must only be penetrated and repaired with same lining material with the consent of the existing lining manufacturer. CONTRACTOR must not compromise any existing warranty.

## 1.03 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be furnished in accordance with Section 01340 – Shop Drawings.
- B. Technical Data: Manufacturers technical data and literature, specifications and installation instructions.
- C. Color Samples: CONTRACTOR shall submit color samples for paint and coatings where colors are designated in the specifications. COLLIER COUNTY will select, with COUNTY concurrence, the colors to be used.

## 1.04 SPECIAL CORRECTION OF DEFECTS REQUIREMENTS

- A. Warranty Inspection: A warranty inspection may be conducted during the eleventh month following completion of all coating and painting WORK or as deemed necessary by the COUNTY. The CONTRACTOR and a representative of the coating material Manufacturer may be requested to attend this inspection. All defective WORK shall be repaired in accordance with these specifications and to the satisfaction of the COUNTY. The COUNTY may, by written notice to the CONTRACTOR, reschedule the warranty inspection to another date within the three-year correction period, or may cancel the warranty inspection altogether. If a warranty inspection is not held, the CONTRACTOR is not relieved of its responsibilities under the Contract Documents.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. Suitability: The CONTRACTOR shall use suitable coating materials as recommended by the Manufacturer.
- B. 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, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.
- C. 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.

- D. Colors: Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples.

## 2.02 INDUSTRIAL COATING SYSTEMS

- A. Material Sources: Each of the following manufacturers is capable of supplying many of the industrial coating materials indicated herein. Where manufacturers and paint numbers are listed, it is to show the type and quality of coatings that are required. All industrial-coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, and water and wastewater treatment plants.
- B. System 1 – Ferrous metal surfaces, indoors or outdoors, exposed or covered, galvanized and not galvanized: All surfaces exposed to the atmosphere that do not come into contact with wastewater or corrosive atmosphere including pumps, motors, machinery, above ground piping, valves and pipe supports, miscellaneous steel shapes, angles, exposed surfaces of electric panels, conduit, ventilation fans, air-conditioning units, duct work, shall have surface preparation and coating system as listed in Article 3.10 of this Section.
  - 1. Metal surfaces that are submerged in wastewater or subjected to wastewater gases including new equipment specified and installed in this Contract, miscellaneous steel, pumps, piping and valves, shall have surface preparation and coating system as listed in Article 3.10 of this Section.
- C. System 2 – Interior coatings for wet wells, valve vaults, master manholes, force main discharge manholes, and manholes within 100-feet of master manholes: The interior of the wet wells of lift stations, valve vaults, the first manhole upstream of a wetwell, manholes where force mains discharge, manholes within 100-feet of master manholes, and other structures as indicated in the Drawings shall be lined as listed in Article 3.11.A. of this Section. All surface preparation shall be as indicated in Article 3.11.A of this Section. A ten-year comprehensive warrantee against failure of workmanship and materials shall be provided by the coating supplier.
- D. System 3 – Exterior coatings for wet wells, manholes, master manholes, force main discharge manholes and valve vaults is not required with the application of Xypex waterproofing additive in concrete mixes. Xypex waterproofing additive is required for all precast concrete wet wells, manholes, master manholes, force main manholes and valve vaults, in accordance with Section 03400 – Precast Concrete.
- E. System 4 - All aluminum surfaces in contact with concrete: All aluminum surfaces in contact with concrete, such as hatch covers for vaults and wetwell shall be coated with coal tar epoxy as listed in Article 3.11.C of this Section.
- F. System 5 – Non-Ferrous Metal, Plastic, and Fiber Glass: The interior of isolated non-ferrous parts associated with equipment or piping shall have surface preparation and shall be coated as listed in Article 3.12 of this Section. Do not coat handrails, gratings,

frames or hatches. Only primers recommended by the coating manufacturer shall be used.

- G. System 6 – Exterior Exposed PVC Piping: The exterior of exposed PVC piping shall have surface preparation and shall be coated as listed in Article 3.13 of this Section.

### PART 3 - EXECUTION

#### 3.01 MANUFACTURER'S SERVICES

- A. If requested by the COUNTY, the CONTRACTOR shall require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support as may be necessary.

#### 3.02 WORKMANSHIP

- A. Skilled craftsmen and experienced supervision shall be used on all 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 ensure thorough cleaning and an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. 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 precautionary measures. Pinholes or holidays will not be allowed in the finished surface of the coating.
- C. All damage to surfaces resulting from the WORK shall be cleaned, repaired, and refinished to original condition and to the satisfaction of the COUNTY. If coating systems are damaged prior to the acceptance by the COUNTY, the COUNTY reserves the right to reject the product or item and require it be replaced at the CONTRACTOR's expense.

#### 3.03 STORAGE, MIXING, AND THINNING OF MATERIALS

- A. Manufacturer's Recommendations: Unless otherwise indicated, 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.
- B. All protective-coating materials shall be used within the manufacturer's recommended shelf life.
- C. Storage and Mixing: Coating materials shall be stored under the conditions recommended by the Material Safety Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

### 3.04 PREPARATION FOR COATING

- A. General: All surfaces to receive protective coatings shall be cleaned prior to application of 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. Surfaces to be coated shall be dry and free of visible dust. Interiors of all wet wells including wet well bottoms shall be completely cleaned and inspected by the OWNER or OWNER'S REPRESENTATIVE prior to any coating.
- 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.
- C. 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.
- D. 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 any and all damage to adjacent WORK or adjoining property occurring from blast cleaning or coating operations.
- E. Protection of Painted Surfaces: Cleaning and coating shall be coordinated so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

### 3.05 SHOP COATING REQUIREMENTS

- A. Unless otherwise indicated, all items of equipment, or parts of equipment which are not submerged, shall be shop primed and then finish coated in the field after installation with the indicated or selected color. The methods, materials, application equipment and all other details of shop painting shall comply with this section. If the shop primer requires finish 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 or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have all surface preparation and coating WORK performed in the field.
- C. 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, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the indicated quality in the field. Such equipment shall be primed and finish coated in the shop and touched up 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.

- D. 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.
- E. 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 30 days before being topcoated or less time if recommended by the coating manufacturer.
- F. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturer's printed instructions. If coating systems are damaged prior to the acceptance by the COUNTY, the COUNTY reserves the right to reject the product or item and require it be replaced at the CONTRACTOR's expense.
- G. 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.
- H. Manufacturers of components regularly used in the COUNTY's utility system may submit factory applied coating systems for pre-approval through the COUNTY's Qualified Products List (QPL) process described in Section 01600. As part of the submittal process, the CONTRACTOR shall provide written verification or certification that the factory applied coating is suitable for the intended use. Factory applied coating systems that have been pre-approved through the COUNTY's QPL process may be used instead of the coating system schedules described herein.

### 3.06 APPLICATION OF COATINGS

- A. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.
- B. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thickness are likely to be present.
- C. Special attention shall be given to materials, which will be joined so closely, that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.
- D. 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.
- E. Coatings shall not be applied under the following conditions:



1. Temperature is above the manufacturers allowable maximum or below the manufacturer's allowable minimum.
  2. Dust or smoke laden atmosphere.
  3. Damp or humid weather that exceeds recommended maximum allowable.
  4. When the substrate or air temperature is less than 5 degrees F above dew point.
  5. When air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dew point within 8 hours after application of coating.
  6. When wind conditions are not calm.
- F. 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. Finish coat shall be applied within 30 days of factory shop prime coating application.
- G. Prior to coating of concrete, CONTRACTOR shall administer a pH test to ensure that the concrete has sufficiently cured. pH testing shall be in the form of a TSW6 test or County approved equal. All concrete must pass pH testing prior to coating.
- H. The full interior of wet wells including the wet well bottom shall be coated prior to installation of the stainless-steel base plate for the pumps.

### 3.07 CURING OF COATINGS

- A. The CONTRACTOR shall maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section; whichever is the most stringent, prior to placing the completed coating system into service.
- B. In the case of enclosed areas, forced air ventilation, using heated air if necessary may be required until the coatings have fully cured.

### 3.08 IDENTIFICATION OF PIPING

- A. Identification of above ground piping shall be in accordance with the table provided below and with additional requirements set forth in Section 15000 – Mechanical, General.
- B. Tnemec Safety Paint colors or a county approved equal shall be used for all projects as indicated below.
- C. All above-ground pipe and fittings, Polyvinyl Chloride (PVC) pipe and fittings, metallic and non-metallic marking tapes, and any other marking device, will be color coded in accordance with the APWA Uniform Color Guide, which is as follows:

Color	Paint Color Number		Application
Red	Candy Apple Red/Safety - 06SF	RGB 186,42,26	Potable Water Hydrant Bonnet (6")
Orange	Tangerine Orange/Safety - 04SF	RGB 217,110,25	Potable Water Hydrant Bonnet (8" and 10"), Communication, Telephone, Alarm, or
Green	Spearmint Green/Safety - 09SF	RGB 48,142,84	Potable Water Hydrant Bonnet (12" and greater)
Yellow	Lemon Yellow/Safety - 02SF	RGB 224,201,62	Potable Water Hydrant Body, Gas, Oil, Steam, Petroleum or Gaseous Material
Lavender	Purple Rain/Safety - 14SF	RGB 137,52,103	Irrigation Water Main
Lavender	Purple Rain/Safety - 14SF	RGB 137,52,103	Irrigation Water Hydrant Body
White	White - 00WH	RGB 248,253,254	Irrigation Water Hydrant Bonnet
Green	Spearmint Green/Safety - 09SF	RGB 48,142,84	Waste Water Forcemain, Sewer
Blue	True Blue/Safety - 11SF	RGB 0,94,145	Potable Water Main
White	White - 00WH	RGB 248,253,254	Irrigation Hydrant Bonnet
Black	N/A	N/A	Above ground HDPE pipe – no coating required

- D. The following colors shall be used in conjunction with the Safety Paint colors for all projects:

Color	Paint Color Number	Application
Light Gray	32GR ANSI No. 70	Electrical (Conduits, Boxes, Motors, Generators, Signal Lines, Etc.) Stainless steel is not coated.

### 3.09 SHOP AND FIELD INSPECTION AND TESTING

- A. Inspection Devices: The CONTRACTOR shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. The CONTRACTOR shall furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings.
- B. Holiday Testing: As directed by the COUNTY, the CONTRACTOR shall holiday test all coated ferrous surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems including manholes and wet wells. 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 & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or County 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 & Rasor Model M1 non-destructive type holiday detector, K-D Bird Dog, or County 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 County approved equal, shall be added to the water prior to wetting the detector sponge.
- C. Film Thickness Testing: On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gage such as Mikrotest model FM, Elcometer model 111/1EZ, or County approved equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 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 gage.
- D. Surface Preparation: The exterior surfaces of pipes, valves and other above ground items that will be exposed to the atmosphere inside structures or above ground will be abrasive blasted to a maximum commercial Grade SSPC-SP-6, NACE 3 and given a high solids epoxy primer coat of Tnemec Series 66 Hi-Build Epoxoline, 4.0 mils DFT at the factory. A finish coat will be applied after installation according the color schedule specified in this Section or as listed in Specification 15000. Evaluation of blast cleaned surface preparation WORK will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standards TM-01-70 and TM-01-75.

### 3.10 SYSTEM 1 COATING SYSTEM SCHEDULES - FERROUS METALS

- A. Coating System Schedule, Ferrous Metal - Not Galvanized:

Item	Surface Prep.	System No.
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Non-immersion: All surfaces indoors and outdoors, exposed or covered, except those included below.	SP-6	(1) Tnemec Primer at the factory – Hi-Build Epoxoline (66), DFT = 3.0 - 5.0 mils Second coat - Hi-Build Epoxoline (66), DFT = 3.0 - 5.0 mils Finish coat – Endura Shield III (73), DFT = min. 2.0 - 3.0 mils  Or County approved equal
Item	Surface Prep.	System No.
Immersion: All surfaces indoors and outdoors, exposed or covered, submerged in wastewater or subjected to wastewater gases	SP-10. Spot field repair damaged areas per SSPC-SP10.	(1) Tnemec Primer at the factory – Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT  Spot Field Repair of Damaged Shop Primer: Tnemec Series 1 @ 2.5-3.5 mils DFT  First Coat: Tnemec Series 446 Perma-Thane @ 5.0-7.0 mils DFT.  2nd Coat: Tnemec Series 446 @ 5.0-7.0 mils DFT.  Or County approved equal

B. Coating System Schedule, Ferrous Metal - Galvanized:

Item	Surface Prep.	System No.
All exposed surfaces indoors and outdoors, except those included below.	SP-7 or per Manufacturer's Instructions	(1) Tnemec Primer at the factory - Hi-Build Epoxoline (66), DFT = 2.5-3.5 mils DFT  Finish coat – 73 Endurashield @ 2.0-3.0)  Or County approved equal

Immersion: All exposed surfaces indoors and outdoors, submerged in wastewater or subjected to wastewater gases	SP-7 or per Manufacturer's Instructions	(1) Tnemec Primer at the factory - Hi-Build Epoxoline (66), DFT = min. 4.0 mils Finish coat – 66 @ 2.5-3.5 mils DFT  Or County approved equal
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### 3. 11 SYSTEM 2 COATING SYSTEM SCHEDULES – WETWELLS, VALVE VAULTS AND MANHOLES

- A. Interior Coating System Schedule, Wetwells, Valve vaults, Force main Manholes, Manholes within 100-feet of Master Manholes, and Master Manholes:

Item	Surface Prep.	System No.
All interior surfaces of sewer wetwells, valve vaults, manholes within 100-feet of master manholes, master manholes, and manholes where forcemains discharge	IET System "Duplex Prep Method" and applications shall be as specified by IET Systems	(1) Wetwell Liner Coating System as manufactured by IET Systems, DFT = min. 60 mils (125 mils for repair lining)  (2) Gas guard

### 3. 12 SYSTEM 3 COATING SYSTEM SCHEDULES – WETWELLS MANHOLES, AND VALVE VAULTS

#### A. Exterior Coating System Schedule, Wetwells, Manholes, Master Manholes, and Valve Vaults:

1. Exterior coating not required with the application of Xypex waterproofing additive. Xypex waterproofing additive is required for all precast concrete structures, in accordance with Section 03400 – Precast Concrete.

### 3. 13 SYSTEM 4 COATING SYSTEM SCHEDULES – ALUMINUM SURFACES

#### A. Aluminum surfaces in contact with concrete:

Item	Surface Prep.	System No.
All aluminum surfaces in contact with concrete (covers for vaults and wetwells)	Per Manufacturer's Instructions       SP-1 and SP-7 or per Manufacturer's Instructions	(4) - Tnemec Primer at the factory - Hi-Build Epoxoline (66), DFT = min. 4.0 mils  Finish coat – Hi-Build Tneme-Tar (46H-413), DFT = min. 16.0 mils  - Or County approved equal

### 3.14 SYSTEM 5 COATING SYSTEM SCHEDULES - NON-FERROUS METAL, PLASTIC, and FIBER GLASS

Item	Surface Prep.	System No.
Interior (non-immersion) non-ferrous parts, plastic and fiberglass	SP-1 and scarify	(5) Tnemec  Primer at the factory - Hi-Build Epoxoline (66), DFT = 2.5-3.5 mils  Finish coat- Hi-Build Epoxoline(66), DFT = min. 2.5-3.5 mils  County Approved Equal
Exterior (non-immersion) non-ferrous parts, plastic and fiberglass	SP-1 and scarify	(5) Tnemec  Primer at the factory - Hi-Build Epoxoline (66), DFT = 2.5-3.5 mils  Finish coat - Endura Shield III (73) , DFT = min. 2.0 - 3.0 mils  County Approved Equal

### 3.15 SYSTEM 6 COATING SYSTEM SCHEDULES - EXPOSED PVC PIPE

Item	Surface Prep.	System No.
Exterior PVC Pipelines	SP-1 and scarify	(6) Tnemec  Primer at the factory - Endura Shield III (73), DFT = min. 2.0 - 3.0 mils  Finish coat - Endura Shield III (73), DFT = min. 2.0 - 3.0 mils  County Approved Equal

END OF SECTION

## SECTION 09900

### PAINTING

#### PART 1 - GENERAL

##### 1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Water Works Association (AWWA):
    - a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines- Enamel and Tape-Hot-Applied.
    - b. C209, Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
    - c. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
    - d. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
  2. ASTM International
    - a. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.
    - b. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
  3. Environmental Protection Agency (EPA).
  4. International Concrete Repair Institute (ICRI) Guideline No. 310.2 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
  5. NACE International (NACE): SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
  6. ANSI / NSF International (NSF): 61, Drinking Water System Components- Health Effects.
  7. National Association of Pipe Fabricators (NAPF)
    - a. 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe.
  8. Occupational Safety and Health Act (OSHA).



9. The Society for Protective Coatings (SSPC):
  - a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
  - b. PA 3, Guide to Safety in Paint Applications.
  - c. SP 1, Solvent Cleaning.
  - d. SP 2, Hand Tool Cleaning.
  - e. SP 3, Power Tool Cleaning.
  - f. SP 5, White Metal Blast Cleaning.
  - g. SP 6, Commercial Blast Cleaning.
  - h. SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.
  - i. SP 10, Near-White Blast Cleaning.
  - j. SP 11, Power Tool Cleaning to Bare Metal.
  - k. SP 12, Surface Preparation and Cleaning of Metals Waterjetting
    - 1) Prior to Recoating.
  - l. SP 13, Surface Preparation of Concrete.
  - m. SP 16, Brush-off Blast cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
  - n. Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.
  - o. TU 11, Inspection of Fluorescent Coating Systems.

#### 1.02 SUMMARY

- A. Furnish all materials, labor, equipment, and incidentals required to provide a protective coating system for the surfaces listed herein and not otherwise excluded. All surfaces described shall be included within the scope of this Section.
- B. The work includes painting and finishing of interior and exterior exposed items and surfaces such as walls, floors, miscellaneous metal, doors, frames, construction signs, posts, pipes, fittings, valves, equipment, and all other work obviously required to be painted unless otherwise specified herein or on the Drawings. The omission of minor items in the schedule of work shall not relieve the CONTRACTOR of his obligation to include such items where they come within the general intent of the Specifications as stated herein. The following major items of the Project shall be coated:

1. Interior of cast-in-place concrete and concrete block walls and concrete ceilings and exterior concrete block and stucco walls. This shall include the interior and exterior of the proposed Building including wood and cement fiber wood trim, ceilings and wall.
  2. Exterior of concrete structures including concrete supports and exposed concrete slabs.
  3. Submerged surfaces and surfaces exposed to potable water of any ferrous metal and aluminum components of equipment, piping, fittings and valves (except stainless steel).
  4. Exposed ferrous surfaces of equipment, pumps, motors, and ferrous or galvanized metal fittings and accessories.
  5. Exposed ferrous metal surfaces of Crane Rail System and ferrous or galvanized metal fittings and accessories.
  6. Exposed surfaces of PVC components of piping, fittings, valves, electrical conduit, and equipment.
  7. Exposed exterior surfaces of all metallic piping, fittings, and valves located on the interior and exterior.
  8. Embedded aluminum or aluminum in contact with dissimilar metals or in contact with corrosive atmospheres.
- C. "Paint" as used herein means all coating systems, materials, including primers, emulsions, enamels, epoxies, sealers and fillers, and other applied materials whether used as a prime, intermediate, or finish coats.
- D. The following items will not be painted unless otherwise noted:
1. Any code-requiring labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.
  2. Any moving parts of operating units, such as valve and damper operators, linkages, sensing devices, and motor and fan shafts.
  3. Aluminum or fiberglass handrails, walkways, toeboards, windows, louvers, grating, checker plate, hatches, and stairways.
  4. Stainless steel angles, tube, pipe, etc.
  5. Products with polished chrome, aluminum, nickel, or stainless steel finish.
  6. Stainless steel, brass, bronze, and aluminum other than exposed utility tubing.

7. Flexible couplings, lubricated bearing surfaces, insulation, and plastic pipe or duct interiors.
  8. Plastic switch plates and receptacle plates.
  9. Signs and nameplates.
  10. Finish hardware.
  11. Packing glands and other adjustable parts, unless otherwise indicated.
  12. Portions of metal, other than aluminum, embedded in concrete. This does not apply to the back face of items mounted to concrete or masonry surfaces which shall be painted before erection. Aluminum to be embedded in, or in contact with, concrete shall be coated to prevent electrolysis.
- E. Ferrous metal surfaces, excluding stainless steel surfaces that will be exposed in the completed Work, shall be sandblasted either at the point of fabrication or under this Section prior to placement of primers. Field fabrication, including welds and cuts, shall be sandblasted, primed, and painted as herein specified.
- F. Ferrous metal items that will be in contact with precast concrete slabs, masonry, etc., shall be finish painted.
- G. Galvanized steel items that are not included under "Work Not Included," shall be prepared, primed, and finish painted as herein specified.
- H. Bruises, mars, and/or scratches in the shop painting due to handling, shall be immediately touched up in the field by Contractor prior to any storage or installation.
- I. Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.
- J. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- K. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect-Engineer will select these from standard colors or finishes available.
- L. Painting of piping includes pipe hangers, valves, and piping accessories, and also includes surfaces that will be in contact with piping supports. ALL PIPING SHALL BE COMPLETELY PAINTED.

- M. Existing surfaces shall be painted where shown and/or called for. Preparation for repainting and priming shall be as herein specified.
- N. Altered existing Work or damaged surfaces that are a result of the revisions shall be painted under this item of Work. The finishes shall match the existing adjacent coatings.
- O. Miscellaneous equipment shipped to Site with factory-applied coatings as follows, shall be painted under this Work as specified:
  - 1. No Factory Finish: Surface preparation, priming, and finish painting.
  - 2. Prime Coat: Surface preparation, touch-up, and finish painting.
  - 3. Intermediate Coat: Surface preparation, touch-up, and finish painting.
  - 4. Pre-finished Equipment: Touch-up as required. Equipment manufacturer shall furnish necessary touch-up paint.
  - 5. Factory finish coats, not matching the approved finish colors, that are provided in lieu of the shop prime specified shall be properly prepared and receive a final field coat to match the adjacent related Work.
- P. Painting as called for on Drawings is for guidance only and does not limit the requirements for painting.

1.03 DEFINITIONS:

- A. Terms used in this section:
  - 1. ASTM D 16, unless otherwise specified.
  - 2. Coverage: total-minimum dry film thickness in mils or square feet per gallon.
  - 3. FRP: Fiberglass Reinforced Plastic.
  - 4. HCl: Hydrochloric Acid.
  - 5. MDFT: Minimum Dry Film Thickness, mils.
  - 6. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
  - 7. Mil: Thousandth of an inch.
  - 8. PDS: Product Data Sheet.
  - 9. PSDS: Paint System Data Sheet.
  - 10. PVC: Polyvinyl Chloride.
  - 11. SFPG: Square Feet per Gallon.

12. SFGPC: Square Feet per Gallon per Coat.

13. SP: Surface Preparation.

1.04 RELATED WORK:

- A. Paint piping and equipment for identification purposes in accordance with Division 15 Mechanical.

1.05 QUALITY ASSURANCE:

- A. Provide the best quality grade of the various types of coatings as regularly manufactured by approved paint material manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.
- B. Provide undercoat paint produced by the same manufacturer as the finish coats. Undercoat and finish coat paints shall be compatible. Use only thinners approved by the paint manufacturer, and use only within recommended limits.
- C. Painting shall be accomplished by experienced painters specializing in industrial painting familiar with all aspects of surface preparations and applications required for this project. Work shall be done in a safe and workmanlike manner.
- D. Standards
  - 1. ASTM.
  - 2. OSHA.
  - 3. NFPA.
  - 4. SSPC.
  - 5. NACE.
  - 6. NSF.
  - 7. AWWA.
- E. Acceptable Manufacturers
  - 1. Tnemec Company, Inc.
  - 2. Carboline Company.
  - 3. Sherwin Williams – Basis of Design.
- F. Products listed in the Class Exposures are the Basis of Design Products only. Other equivalent products by listed manufacturers above may be incorporated into the work.

- G. All paints and materials which comes into contact with raw water shall be ANSI /NSF (Standard 61) approved. The manufacturer furnishing the coating material shall furnish certification to the ENGINEER/OWNER that the materials meet these agency provisions.

#### 1.06 SUBMITTALS:

- A. Materials and Shop Drawings: Submit to the ENGINEER as provided in the General Conditions and Division 1, Shop Drawings, shop drawings, manufacturer's specifications, and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness (DFT).
- B. Schedule
  - 1. The CONTRACTOR shall submit for approval a complete typewritten Schedule of Painting Operations within 90 days after the Notice to Proceed. This Schedule is imperative so that the various fabricators or suppliers may be notified of the proper prime coat to apply. It shall be the CONTRACTOR's responsibility to properly coordinate the fabricators' or suppliers' surface preparation and painting operations with these Specifications. This Schedule shall include for each surface to be painted, the brand name, generic type, solids by volume, application method, the coverage and the number of coats in order to achieve the specified dry film thickness, and color charts. When the Schedule has been approved, the CONTRACTOR shall apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gauges may be utilized by the OWNER or ENGINEER to verify the proper application while work is in progress.
  - 2. It is the intent of this Section that as much as possible all structures, equipment, and piping utilize coating systems specified herein supplied by a single manufacturer. All exceptions must be noted on the Schedule. For each coating system, only one (1) manufacturer's product shall be used.
- C. Color Samples: Manufacturer's standard color charts for color selection by OWNER.
- D. Samples - Painting
  - 1. Paint colors will be selected by the OWNER. Compliance with all other requirements is the exclusive responsibility of the CONTRACTOR.
  - 2. Samples of each finish and color shall be submitted to the OWNER or ENGINEER for approval before any work is started.
  - 3. Samples shall be prepared so that an area of each sample indicates the appearance of the various coats. For example, where three (3) coat work is specified, the sample shall be divided into three (3) areas:
    - a. One (1) showing the application of one (1) coat only.
    - b. One (1) showing the application of two (2) coats.

- c. One (1) showing the application of all three (3) coats.
- 4. Such samples when approved in writing shall constitute a standard, as to color and finish only, for acceptance or rejection of the finish work.
- 5. For piping, valves, equipment and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish, and general characteristics.
- 6. Rejected samples shall be resubmitted until approved.

1.07 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer's name and label in accordance with Section 01600: Materials and Equipment.
  - 1. Provide labels on each container with the following information:
    - a. Name or title of material.
    - b. Fed. Spec. number if applicable.
    - c. Manufacturer's stock number, date of manufacture and expiration date (shelf life).
    - d. Manufacturer's formula or specification number.
    - e. Manufacturer's batch number.
    - f. Manufacturer's name.
    - g. Generic type.
    - h. Contents by volume, for major pigment and vehicle constituents.
    - i. Application instructions: thinning, ambient conditions, etc.
    - j. Color name and number.
  - 2. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps which should be taken to prevent injury to those handling the product.
- B. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers.
- C. Used rags shall be removed from the buildings every night and every precaution taken against spontaneous combustion.

1.08 WARRANTY AND GUARANTEES:

- A. Refer to Division 1: Warranties.
- B. All paint and coatings work performed under these Specifications shall be guaranteed by the coatings applicator for 100 percent of the total coated area for both materials and labor against failures during the warranty period.
- C. Failure under this warranty shall include flaking, peeling, or delaminating of the coating due to aging, chemical attack, or poor workmanship; but it shall not include areas which have been damaged by unusual chemical, thermal, or mechanical abuse.

PART 2 PRODUCTS

2.01 MATERIALS:

- A. All paint shall be manufactured by one of the suppliers listed in Paragraph 1.03E., herein, and shall be their highest grade of paint.
- B. When other than the specified coating suppliers is proposed, the CONTRACTOR shall submit a typewritten list giving the proposed coatings, brand, trade name, generic type and catalog number of the proposed system for the ENGINEER's approval.
- C. Paint used in successive field coats shall be produced by the same manufacturer. Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to underlying paint. Shop paint shall be of the same type and manufacture as used for field painting by the CONTRACTOR.
- D. Rags shall be clean painter's rags, completely sterilized.

2.02 COATING SYSTEMS:

- A. Class 1 Exposures - Interior Concrete and Masonry, Non-immersion, excluding Floors.
  - 1. Examples of this classification include the following surfaces:
    - a. Interior masonry and plaster.
    - b. Concrete block walls.
    - c. Concrete walls, columns and supports.
    - d. Concrete ceilings and beams.
  - 2. Surface Preparation: As specified in Paragraph 3.02, herein, including filling cracks, voids and other surface imperfections, removing mortar droppings, cleaning and air-blasting,
  - 3. Class 1 Coating System:



- a. Prime Coat: Manufacturer Recommended Surfacer or Block Filler
  - 1) Actual coverage is dependent on the porosity of the substrate to be coated.
- b. Finish Coats: Two Component Water Based Catalyzed Epoxy:
  - 1) Two (2) coats for a total finish thickness of 5.0 – 8.0 mils DFT.

NOTE: MAXIMUM ELAPSED TIME BETWEEN COATS, AS STATED BY THE COATING MANUFACTURER, SHALL NOT BE EXCEEDED.

B. Class 2 Exposures – Interior Wood and Cement Fiber Wood Trim, and Gypsum Wallboard and Ceilings.

- 1. Surface Preparation: Clean and dry and as specified in Paragraph 3.02, herein,
- 2. Class 1 Coating System:
  - a. Prime Coat: Latex Primer Sealer
    - 1) 1.5 – 2.0 mils DFT.
  - b. Finish Coats: Acrylic Latex:
    - 1) Two (2) coats for a total finish thickness of 3.0 – 5.0 mils DFT.

C. Class 3 Exposures – Buried Exterior Concrete Surfaces

- 1. Class 3 Exposures shall consist of all exterior below grade surfaces for precast concrete structures and all exterior below grade concrete or masonry surfaces for building stemwells.
- 2. Surface Preparation: As specified in Paragraph 3.02 herein and in addition the following:
  - a. SSPC-SP 13 to achieve ICRI CSP as required by coating supplier.
  - b. Concrete surfaces shall be patched to produce a consistent, void free surface, eliminating all air pockets, pinholes, bug holes, tie holes, form fins and burrs, honeycombs and cracks. Patching compound shall be a compatible with the coating system.
  - c. Prior to application of coating system, surfaces shall be clean and dry.
- 3. Class 3 Coating System
  - a. Coal Tar Epoxy
  - b. Application may be one or two coats.

- c. Total system finish coating thickness shall be 16.0 – 24.0 mils DFT.
- D. Class 4 Exposures – Concrete, Masonry, and Stucco Exterior, Non-Immersion
  - 1. Class 4 exposures consist of exposed exterior concrete and masonry surfaces of new buildings and structures subjected to normal exterior elements and not subjected to water immersion. Class 4 exposures shall include the following:
    - a. Exterior, aboveground concrete surfaces of new structures.
  - 2. Surface Preparation: As specified in Paragraph 3.02 herein and in addition the following:
    - a. New masonry surfaces shall be prepared by filling cracks, voids and other surface imperfections, removing mortar droppings, cleaning and high pressure water blasting.
    - b. New concrete surfaces shall be prepared as required for Class 3 exposure surface preparation specified in Paragraph 2.02.C.2 above.
    - c. Existing concrete surfaces shall be prepared by high pressure water blasting or abrasive blast cleaning to remove existing deteriorated or disbonded coatings as required for adhesion of the new coating system.
  - 3. Class 4 Coating System
    - a. Prime Coat for Previously Coated Structures: If required and as recommended by the coating supplier
    - d. Finish Coats: High quality elastometric coating.  
  
Two coats.
    - e. Total system finish coating thickness shall be 12.0 – 18.0 mils DFT..
- E. Class 5 Exposures – Not Used
- F. Class 6 Exposures - Metals, Immersion (Interior and Exterior), Non-Immersion (Interior) and Metal Crane Rail System.
  - 1. Class 6 exposures consist of interior and exterior metal surfaces (immersion) and interior metal surfaces that do not come in direct contact with water or corrosive atmospheres and shall include the following:
    - a. Pumps, motors, equipment and appurtenances.
    - b. Aboveground piping, fittings, valves and metal electrical conduit.
    - c. Miscellaneous steel plates, shapes, hardware, etc.

- d. Galvanized steel surfaces.
  - e. Other surfaces obviously requiring field coating or as specified to be field coated in Division 11.
2. Surface Preparation: As specified in Paragraph 3.02 herein and, in addition, the following:
- a. Non-immersion metals shall be abrasive blast cleaned to SSPC-SP6. Immersion metals shall be abrasive blast cleaned to SSPC-SP10.
  - b. All bare metals or areas that were shop primed that have been damaged shall be abrasive blast cleaned to the appropriate, commercial blast cleaning standards.
  - c. Shop primed items shall be prepared for coating following the coating manufacturer's recommendations prior to applying touch-up and subsequent coats. Surface preparation of immersion surfaces requires sweep blast cleaning to uniformly dull the shop primed surfaces prior to topcoating. Other surface may also require sweep blast cleaning. Spot blast cleaning to the appropriate blast cleaning standards for areas where the primer has been damaged and bare metal is showing is required.
  - d. Non-ferrous metals shall be degreased and cleaned in accordance with SSPC-SP 16.
3. Class 6 Coating System (Immersion)
- a. Prime Coat for Ferrous and Non-Ferrous Metals: ANSI / NSF Part 61 approved, two-part epoxy primer at 3.0 – 5.0 mils DFT.
  - b. Finish Coat for Non-Ferrous Metals: NSF Part 61 approved epoxy coating at 5.0 – 7.0 mils DFT.
  - c. Finish Coats for Ferrous Metal: NSF Part 61 approved, two component, cross linked epoxy.  
  
Two coats at 5.0 – 7.0 mils DFT per coat.
  - d. Total system finish coating thickness shall be 13.0 – 19.0 mils DFT for ferrous metals and 8.0 – 13.0 mils DFT for non-ferrous metals.
4. Class 6 Coating System (Non-Immersion & Metal Crane Rail System)
- a. Prime Coat for Ferrous and Non-Ferrous Metals: Two component, cross-linked epoxy primer at 3.0 – 5.0 mils DFT.
  - b. Finish Coat for Non-Ferrous Metals: Two-part epoxy at 3.0 – 5.0 mils DFT.

- c. Finish Coat for Ferrous Metal: Two component, cross-linked epoxy 3.0 - 5.0 mils DFT.
- d. Total system finish coating thickness shall be 9.0 – 15.0 mils DFT for ferrous metals and 3.0 – 10.0 mils DFT for non-ferrous metals.

NOTE: MAXIMUM ELAPSED TIME BETWEEN COATS, AS STATED BY THE COATING MANUFACTURER, SHALL NOT BE EXCEEDED.

G. Class 7 Exposures - Plastic Piping, Valves, Fittings, and Conduit, Interior and Exterior

- 1. Class 7 exposures consist of PVC or fiberglass piping or electrical systems requiring color coding, and for protection of exposed, exterior plastic components from the elements, and shall include the following:
  - a. PVC and fiberglass piping, fittings, valves, and electrical conduits requiring color coding in accordance with Division 15 Mechanical.
  - b. Exposed exterior plastic piping, valve, and fitting components subject to UV degradation and weathering by the elements.
- 2. Surface Preparation: As specified in Paragraph 3.02 herein, including cleaning and washing with detergent to remove all dirt and foreign material, and light surface abrasion using medium grade sandpaper. Remove dust, dirt and debris with clean rags prior to coating.
- 3. Class 7 Coating System:
  - a. Prime Coat: Acrylic Latex at 2.0 - 4.0 mils DFT.
  - b. Finish Coat: Acrylic Latex at 2.0 – 4.0 mils DFT.
  - c. Total system finish coating thickness shall be 4.0 – 6.0 mils DFT.

H. Class 7A Exposures – Kraft Paper, Vinyl, PVC, Aluminum, or Stainless Steel Insulation Jacketing, Interior and Exterior

- 1. Class 7A exposures consist of Kraft Paper, Vinyl, PVC, Aluminum, or Stainless Steel pipe insulation jacketing surfaces requiring color coding, and for protection of exposed, exterior plastic components from the elements, and shall include the following:
  - a. Kraft Paper, Vinyl, PVC, Aluminum, or Stainless Steel pipe insulation jacketing requiring color coding in accordance with Division 15 Mechanical.
  - b. Exposed exterior Kraft Paper, Vinyl, PVC, Aluminum, or Stainless Steel pipe insulation jacketing subject to UV degradation and weathering by the elements.

2. Surface Preparation: As specified in Paragraph 3.02 herein, including cleaning and washing with detergent to remove all dirt and foreign material, and light surface abrasion using medium grade sandpaper. Remove dust, dirt and debris with clean rags prior to coating. For aluminum or stainless steel insulation jacketing a compatible wash primer may be used with Engineer approval.
  3. Class 7A Coating System:
    - a. Prime Coat: Acrylic Latex at 2.0 - 4.0 mils DFT.
    - b. Finish Coat: Acrylic Latex at 2.0 – 4.0 mils DFT.
    - c. Total system finish coating thickness shall be 4.0 – 6.0 mils DFT.
- I. Class 8 Exposures - Aluminum
1. Class 8 exposures consist of aluminum surfaces embedded or in contact with concrete, mortar or plaster, or aluminum in contact with dissimilar metals which may cause corrosion due to electrolysis, and shall include the following:
    - a. Aluminum surfaces in contact with concrete, mortar or plaster, such as hatch cover frames, etc.
    - b. Aluminum surfaces in contact with dissimilar metals which may cause corrosion due to electrolysis.
  2. Surface Preparation: SSPC-SP 16 and as specified in Paragraph 3.02 herein, including solvent cleaning in accordance with SSPC-SP1 standards for solvent cleaning and scarification.
  3. Class 8 Coating System:
    - a. Prime Coat: Two component epoxy at 3.0 – 5.0 mils DFT.
    - b. Finish Coats for Aluminum Exposed to View: Two-component, high build, acrylic urethane at 2.0 -5.0 mils DFT.
    - c. Finish Coat for Aluminum Not Exposed to View: Polyamide cured coal tar epoxy at 16.0 – 24.0 mils DFT.
    - d. Total system finish coating thickness shall be 19.0 – 29.0 mils DFT for areas not exposed to view or 5.0 – 10.0 mils for areas exposed.
- J. Class 9 Exposures - Metals Exterior Exposed
1. Class 9 exposures consist of exterior metal surfaces exposed to the weather and environment.
    - a. Pumps, motors, equipment, and appurtenances

- b. Above ground piping, fittings, valves, and metal conduit
  - c. Miscellaneous metal surfaces
  - d. Ladders, stairways, structural steel
  - e. Roof mounted equipment, hatches, fans, etc.
  - f. Galvanized and non-ferrous metal surfaces
  - g. Other surfaces obviously requiring field painting
- 2. Surface Preparation: As specified in paragraph 3.02 herein and, in addition, the following:
  - a. All bare metals or areas that were shop primed that have been damaged shall be abrasive blast cleaned to SSPC-SP6, commercial blast cleaning standards.
  - b. Shop primed items shall be prepared for coating following the coating manufacturer's recommendations prior to applying touch-up and subsequent coats. Surface preparation may include sweep abrasive blast cleaning or spot blasting to SSPC-SP6, commercial blast cleaning standards, for areas where the primer has been damaged and bare metal is showing.
  - c. Non-ferrous metals shall be degreased and cleaned by washing with SSPC-SP 16.
- 3. Class 9 Coating System
  - a. Prime coat for ferrous and non-ferrous metal: Two part epoxy primer at 3.0 – 5.0 mils DFT.
  - b. Intermediate coat for ferrous metal: Two part epoxy at 3.0 – 5.0 mils DFT.
  - c. Finish coat for ferrous and non-ferrous metal: High Build Acrylic Polyurethane at 2.0 - 5 mils DFT.
  - d. Total system finish shall be 5.0 – 10.0 mils for non-ferrous metal and 8.0 - 15.0 mils for ferrous metal surfaces.
- K. Class 10 Exposures – NOT USED
- L. Class 11 Exposures - Interior Floors (Painted)
  - 1. Class 11 exposures consist of interior concrete floors.

2. Surface Preparation: SSPC – SP- 13 and as specified in Section 3.02F in addition to the following:
    - a. Abrasive blast clean to remove laitance and roughen the surface to achieve an ICRI CSP as required by the coating supplier.
  3. Class 11 Coating System
    - a. Primer: Two-component Waterborne Epoxy at 3.0 – 5.0 mils DFT.
    - b. For non-skid areas add skid resistant additive to the mixed material or broadcast into the wet primer to achieve the desired non-slip finish.
    - c. Topcoat: Two-component Waterborne Epoxy at 3.0 – 5.0 mils DFT.
- M. Class 12 Exposures - NOT USED
- N. Class 13 Exposures - Interior Floors (Sealed) with skid resistant non-slip finish.
1. Class 13 exposures consist of interior concrete floors and surfaces that require a sealer.
  2. Surface Preparation: SSPC-SPC 13 and as specified in Section 3.02F in addition to the following:
    - a. Abrasive blast clean to remove laitance and roughen the surface to achieve ICRI CSP as required by coating supplier.
  3. Class 13 Coating System
    - a. Coating: Two-component High Solids Epoxy Primer / Sealer applied at 10.0 -12.0 mils DFT in a single coat.
    - b. Broadcast in skid resistant additive for a non-slip finish.
- O. Class 14 Exposures - Exposed Concrete Floors
1. Class 14 exposures consist of exterior concrete surfaces that are exposed to the weather elements and occasional immersion of water and receive light foot traffic.
  2. Surface Preparation: SSPC-SP 13 and as specified in Section 3.02F in addition to the following:
    - a. Abrasive blast clean to remove laitance and roughen the surface to achieve ICRI CSP as required by coating manufacturer.
  3. Class 14 Coating System.
    - a. Primer: Two coats of two-component epoxy at 4.0 -6.0 mils DFT.

- b. Topcoat: Aliphatic Polyurethane.
      - 1) One coat at 2.0 -3.0 mils DFT.
    - c. Minimum DFT for the three coats is 10.0 mils.
  - P. Class 15 Exposures – Exterior Wood and cement fiber wood products.
    - 1. Exterior Wood and Cement Fiber wood products:
      - a. 1 coat of latex primer at 1.5 dry mils minimum
      - b. Apply 2 coats of an acrylic latex finish at 2.0 dry mils minimum.
  - Q. Class 16 Exposures – Interior Wood Doors, Trim, Casings, Etc
    - 1. Class 16 exposures consist of interior wood doors, trim, casings or wood surface exposed to dry conditions and normal wear and use patterns.
    - 2. Surface Preparation – prepare wood surfaces for stain by sanding using 80 to 120 grit sandpaper, then wiping the surface with tack cloths to remove residue. Lightly sand in between coats of varnish with 180-220 grit sandpaper.
    - 3. Class 16 Coatings - Stain & Clear Coat Systems
      - a. 1 coat <250g/l VOC Compliant Wood Stain (to match sample)
      - b. 1 coat – Waterbourne Polyurethane Varnish @ 3.0-4.0 mils WFT
      - c. 1 coat – Waterbourne Polyurethane Varnish @ 3.0-4.0 mils WFT

### PART 3 - EXECUTION

#### 3.01 SHOP PAINTING:

- A. Surface Preparation - All ferrous metal to be primed in the shop shall have all rust, dust and scale, as well as all other foreign substances, removed by abrasive blast cleaning or pickling in accordance with SSPC-SP 10 or SP8, respectively. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting. Under no circumstances will cleaned metal be allowed to sit overnight before priming, or pretreatment and priming. All nonferrous metals shall be solvent cleaned prior to the application of primer. In addition, galvanized surfaces which are to be top coated shall first be degreased then primed.
- B. Materials Preparation
  - 1. Mix and prepare painting materials in strict accordance with manufacturer's recommendations and directions, stirring materials before and during application



to maintain a mixture of uniform density, free of film, dirt and other foreign materials.

2. No thinners shall be used except those specifically mentioned and only in such quantity as directed by the manufacturer in his instructions. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or clean-up solvent shall be used for all clean-up. Application by brush, spray, airless spray or roller shall be as recommended by the manufacturer for optimum performance and appearance.

C. Applications

1. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship. Coating systems shall be as specified herein.
2. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied.
3. All paint and coatings materials shall be stored under cover and at a temperature within 10°F of the anticipated application temperature and at least 5°F above the dew point.
4. 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.
5. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be applied in a manner that will produce an even film of uniform and proper thickness.
6. Paint back sides of access panels and removable or hinged covers to match the exposed surfaces.
7. Equipment manufacturer or supplier shall provide touch-up paint for items with shop applied finish coats.
8. Where specified in the individual Sections, primer coat(s) shall be applied in the shop by the equipment manufacturer. The shop coats shall be as specified and shall be compatible with the field coat or coats.

- D. Certification: The CONTRACTOR shall obtain from the equipment manufacturer or supplier, prior to shipment of equipment, a written certification that surface preparation, coating brand, material, DFT, and application method complied with this Section.

### 3.02 SURFACE PREPARATION:

- A. All dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces which are to be coated.
- B. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items and surfaces not to be painted which are in contact with or near surfaces to be painted shall be removed, masked, or otherwise protected prior to surface preparation and painting operations. Refer to Paragraph 3.09B.
- C. Before commencing work, the painter must make certain that surfaces to be covered are in proper condition and must obtain ENGINEER's approval to proceed. Should the painter find such surfaces impossible of acceptance, he shall report such fact to the ENGINEER. The application of paint shall be held as an acceptance of the surfaces and working conditions and the painter will be held responsible for the results reasonably expected from the materials and processes specified. Reference the paint manufacturer's product data sheet for specific surface preparation requirements prior to product application.
- D. Program the cleaning and painting so contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.
- E. Ferrous Metal Surfaces
  - 1. Remove any oil or grease from surfaces to be coated with clean rags soaked in a solvent recommended by coating manufacturer in accordance with SSPC specifications. Any chemical contamination shall be eliminated by means of neutralization or flushing or both prior to additional surface preparation.
  - 2. For immersion service, all sharp edges and welds shall be ground to a rounder contour, all weld splatter shall be removed, and all pits and dents shall be filled, and all imperfections shall be corrected prior to abrasive blast cleaning.
  - 3. For non-immersion service, all sharp edges and welds shall be ground, all weld splatter shall be removed, all pits and dents shall be filled, and all imperfections shall be corrected prior to sandblasting.
  - 4. For immersion service, all surfaces to be coated shall be abrasive blast cleaned to near-white metal in accordance with SSPC-SP 10. . The proper abrasive to obtain the specified surface profile (anchor pattern) designated in the coating manufacturer's most recent printed application instructions shall be used. After abrasive blast cleaning, dust and spent abrasive shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting preparation is finished and always before the surface starts to rust. No cleaned surface shall stand overnight before coating.
  - 5. For non-immersion service, or wherever specified in the coating manufacturer's most recent printed application instructions for other services, all surfaces to be coated shall be abrasive blast cleaned in accordance with SSPC-SP 6 Commercial Blast Cleaning. The proper abrasive to obtain the specified surface profile (anchor

pattern) designated in the coating manufacturer's most recent printed application instructions shall be used. After abrasive blast cleaning, dust and spent abrasive shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting preparation is finished and always before the surface starts to rust. No cleaned surface shall stand overnight before coating.

6. Where blast cleaning is done in the field, only "virgin" sand, grit, or abrasive will be used.
7. Inaccessible areas, such as skip-welded lap joints, or in between back-to-back angle iron bracing, shall be coated before assembly to prevent corrosive action from taking place in these inaccessible areas. All surface voids shall be seal-welded. Sharp corners and edges shall be ground to a smooth contour and welds prepared as described above.

F. Concrete Surfaces

1. All efflorescence, laitance, chalk, dust, dirt, oils, grease, concrete curing agents, form release agents, sealers, old coatings and other chemical contaminants shall be removed in accordance with SSPC-SP 13. Allow to dry thoroughly before coating.
2. All concrete surfaces to be coated shall be clean and dry. "Dry" is defined for new concrete as free of moisture and fully cured which is a minimum of 28 days at 75°F and 50 percent relative humidity or some equivalent cure time at other conditions (7 days minimum for stucco). Moisture content of concrete shall be determined by using both of the following methods.
  - a. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.
  - b. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
3. Old paint and unremoved tar stains shall be solvent cleaned. Proper safety precautions shall be observed if this step is necessary. The surface shall be flushed with fresh water and dried.
4. Do not use form oils incompatible with coating, concrete curing agents, or concrete hardeners on concrete surfaces to be coated.
5. Concrete and/or cinder block walls to receive a coating shall be air-blasted with 100 psi clean, dry, oil-free air to remove dust, etc., and wire brushed to remove all loose and/or weak mortar. See requirements for sumps, tanks and other water-bearing structures below.
6. Concrete walls, floors, sumps, and tanks shall be thoroughly swept clean and then prepared in accordance with SSPC-SP 13 to achieve an ICRI CSP as required by the

coating supplier... Patch voids and cracks that will cause discontinuities in the coating or unsightly appearance using a patching compound compatible with the coating system.

- G. Wood Surfaces: Wood shall be clean and dry. Remove surface deposits of sap or pitch by scraping and wiping clean with rags dampened with mineral spirits or other solvent. Seal knots and pitch pockets with shellac or other sealer before sandpaper and finishing with fine grit and remove sanding dust. After the prime coat is dry, fill cracks and holes with putty or spackling compound. When filler is hard, sand flush with the surface using fine grit sandpaper. Sand lightly between coats with fine grit, open-coated sandpaper
- H. Galvanized Steel and Non-Ferrous Metal
  - 1. Galvanized steel and aluminum will only be coated when so specified.
  - 2. Surfaces shall be clean and dry and be prepared in accordance with SSPC-SP 16.. Remove dust and dirt by blowing off the surface with high pressure air or wiping clean with dry rags. Oil, grease and protective mill coatings shall be removed by solvent cleaning in accordance with SSPC-SPL.
  - 3. Other surface preparation as outlined in the coating manufacturer's latest written application instructions shall be observed for more demanding exposures.
- I. Stainless Steel
  - 1. Stainless steel will only be coated when so specified, or when it is adjacent to areas to be coated such as piping supports, anchor bolts or flange bolts.
  - 2. Stainless steel shall be prepared in accordance with SSPC-SP 16. Only solvents and cleaning solutions containing less than 200 ppm of halogens should be used to prevent stress corrosion cracking.
  - 3. The height of the profile and the texture required shall be defined for the operator and as a standard for the acceptance of the work. Pictorial standards for the surface cleanliness of carbon steel are not applicable to stainless steel, since there are no corrosion products or mill scale to remove from the surface.
  - 4. Only very hard abrasive media shall be used for a fast cutting action and to obtain a sharp angular profile.
- J. PVC or Other Plastic Piping or Ductwork
  - 1. Solvent clean.
  - 2. If recommended by manufacturer, lightly abrade surface with medium grade sandpaper. Remove dust by wiping with clean rags.

### 3.03 MATERIALS PREPARATION:

- A. Mix and prepare painting materials in strict accordance with manufacturer's recommendations and directions, stirring materials before and during application to maintain a mixture of uniform density, free of film, dirt, and other foreign materials.
- B. Except where otherwise specified, thinning shall be done only if necessary for the workability of the coating material and then, only in accordance with the coating manufacturer's most recent printed application instructions. Use only thinner provided by coating manufacturer. If thinning is used, sufficient additional coats shall be applied to assure the required dry film thickness is achieved. The manufacturer's recommended thinner or clean-up solvent shall be used for all clean-up. Application by brush, spray, airless spray or roller shall be as recommended by the manufacturer for optimum performance and appearance.

#### 3.04 APPLICATION:

- A. Paint all exposed surfaces in rooms scheduled for painting whether or not colors are designated in schedules, except where the natural finish of material is obviously intended and specifically noted as a surface that will not be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color of finish is not designated, the ENGINEER will select these from standard colors available for the materials systems as specified.
- B. Color Selection
  - 1. Colors for Multi-Coat Systems: Each coat shall be applied in a different color or shade from the preceding coat to aid in determining the uniformity and coverage of the coating. The finish coat color shall be selected by the OWNER or ENGINEER. When a white finish coat is specified, the last two (2) coats shall be white.
  - 2. Color Coding Piping: All exposed piping shall be identified as specified in Division 15 Mechanical.
- C. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship.
- D. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied. All equipment shall be maintained in good working order and shall be comparable to that described in the coating manufacturer's most recent application instructions. It shall be thoroughly cleaned and inspected daily. Worn spray nozzles, tips, etc., shall be replaced regularly. Effective oil and water separators shall be used and serviced on all air lines.
- E. All paints and coating materials shall be stored under cover and at a temperature within 10°F of the anticipated application temperature and at least 5°F above the dew point.
- F. 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.

- G. Paint shall be applied in a neat manner with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be applied in a manner that will produce an even film of uniform and proper thickness. Allow each coat to dry thoroughly before applying the next coat following manufacturer's recommendations taking into account temperature and relative humidity.
- H. All interior surfaces of structures shall be finish coated prior to installation of equipment, conduit, and other exposed items. Paint back sides of access panels and removable or hinged covers to match the exposed surfaces.
- I. Finish exterior doors on tops, bottoms, and side edges the same as the exterior faces, unless otherwise indicated.
- K. Omit the field primer on metal surfaces which have been shop-primed and touch-up painted, unless otherwise specified.
- L. The prime and intermediate coats as specified for the various coating systems may be applied in the shop by the manufacturer. The shop coats shall be of the type specified and shall be compatible with the field coating. Items such as pumps, motors, equipment, electrical panels, etc. shall be given at least one touch-up coat with the intermediate coating material and one (1) complete finish coat in the field.

### 3.05 APPLICATION RESTRICTIONS:

#### A. Environmental Requirements

- 1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
  - a. The conditions below shall be adhered to even if manufacturer's recommendations are less stringent. If manufacturer's recommendations are more stringent, they shall apply.
  - b. Surface temperature shall be at least 5°F above the dew point during final surface preparation and coating application. Do not apply coatings when the relative humidity exceeds 85 percent or to damp or wet surfaces, unless otherwise permitted by the coating manufacturer's printed instructions. No painting shall be done when the surfaces may become damaged by rain, fog or condensation or when it is anticipated that these conditions will prevail during the drying period, unless suitable enclosures to protect the surface are used. Where heat is necessary, it shall be supplied by the painting applicator and shall be by indirect means only. Further, this heater shall be of such type as not to contaminate the surface area to be or being coated with combustion products. The CONTRACTOR shall supply utilities to run electric or gas heaters. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the OWNER or ENGINEER.

2. Do not apply finish in areas where dust is being or will be generated during application through full cure.
  3. All exterior painting shall be done only in dry weather.
  4. Exterior spray application shall occur only when wind velocities, including gusts, are less than 10 miles per hour. All materials, equipment, etc. in the vicinity of spray application shall be protected from overspray.
- B. Application of materials shall be done only on properly prepared surfaces as herein specified. Between any two coats of material, unless specifically covered in the coating manufacturer's most recent printed application instructions, if more than one (1) week passes between subsequent coats, the coating manufacturer shall be contacted for his recommended preparation of the surface prior to application of the next coat. This preparation might include brush-off blasting, steam cleaning, or solvent wiping (with an indicated solvent) and shall be specified in writing by the material supplier and followed by the applicator. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the OWNER or ENGINEER.

### 3.06 MINIMUM COATING THICKNESS:

- A. Coating thickness shall meet or exceed the specified minimum dry film thickness (DFT) in all areas as measured in accordance with SSPC PA-2. If the measured DFT is below this value, the surface shall be recoated.
- B. Coverage rates are theoretical as calculated by the coating manufacturer and are, therefore, the maximum allowable.
- C. Apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others.
- D. On masonry, application rates will vary according to surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.
- E. Recoat primed and sealed walls and ceilings 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.

### 3.07 FINISHES:

- A. 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.
- B. Complete Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specific requirements.

### 3.08 FIELD QUALITY CONTROL:

#### A. Required Inspections and Documentation:

1. Verify coatings and other materials are as specified. Document batch numbers.
2. Verify environmental conditions are as specified.
3. Verify surface preparation and application are as specified.
4. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges. DFT's shall be measured in accordance with SSPC-PA2.
5. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
  - a. Check for holidays on interior steel immersion surfaces using holiday detector in accordance with NACE SP0188 or SSPC TU-11 using a safe blue light inspection lamps if OAP technology is used.
6. Report:
  - a. Prepare inspection reports daily.
  - b. Submit written reports describing inspections made and actions taken to correct nonconforming work.
  - c. Report nonconforming work not corrected.
  - d. Submit copies of report to Engineer and Contractor.

#### B. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

### 3.09 PROTECTION:

- A. All other surfaces shall be protected while painting.
- B. Protection of furniture and other movable objects, equipment, fittings, and accessories shall be provided throughout the painting operation. Remove all electric plates, surface hardware, etc., before painting; protect and replace when completed. Mask all machinery nameplates and all machined parts not to receive paint. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage.

### 3.10 CLEANING:



- A. The CONTRACTOR shall perform the work under this Section while keeping the premises free from accumulation of dust, debris, and rubbish and shall remove all scaffolding, paint cloths, paint, empty paint containers, and brushes from buildings and the project site when completed.
- B. Cleaning: All paint brushed, splattered, spilled, or splashed on any surface not specified to be painted shall be removed.
- C. The CONTRACTOR shall insure that all glass throughout the facility is cleaned of dirt and paint before he leaves the job site. Further, the CONTRACTOR shall insure that all glass is thoroughly washed and polished.
- D. Upon completion of the project, the job site shall be left neat and clean.

3.11 EXTRA STOCK:

- A. Paint To Be Supplied To OWNER: Upon completion of painting work, the OWNER shall be furnished at no additional cost, unopened containers providing a minimum of one (1) gallon of each type and color of finish paint for touching up. Multi-component coatings shall have each component supplied in separate containers boxed together. Paint container labels shall be complete with manufacturer's name, generic type, number, color, and location where used.

END OF SECTION

## SECTION 12500

### FURNITURE

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes:

1. Computer Desk.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with General Conditions covering the items included under this Section.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

1. Computer Desk:
  - a. Coleshome 71 Inch Computer Desk with USB Ports, Large Office Desk, Long Study Student Writing Desk, Black OR approved equal.

##### 2.02 COMPUTER DESK

- A. Computer Desk shall be approximately 71" by 25" OR approved size by OWNER
- B. Desk shall be made with engineered wood or metal.

#### PART 3 - EXECUTION

##### 3.01 GENERAL

NOT USED

END OF SECTION

SECTION 13340  
(PEMB) METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Structural-steel framing.
  - 2. Insulated Metal roof panels.
  - 3. Insulated Metal wall panels.
  - 4. Metal soffit panels.

1.3 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.4 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to metal building systems including, but not limited to, the following:
    - a. Condition of foundations and other preparatory work performed by other trades.
    - b. Structural load limitations.
    - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
    - d. Required tests, inspections, and certifications.

- e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
- 2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
  - a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
  - b. Structural limitations of purlins and rafters during and after roofing.
  - c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
  - d. Temporary protection requirements for metal roof panel assembly during and after installation.
  - e. Roof observation and repair after metal roof panel installation.
- 3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
  - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
  - b. Structural limitations of girts and columns during and after wall panel installation.
  - c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
  - d. Temporary protection requirements for metal wall panel assembly during and after installation.
  - e. Wall observation and repair after metal wall panel installation.

## 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Insulated Metal roof panels.
    - b. Insulated Metal wall panels.
    - c. Metal soffit panels.
- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
  - 1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
  - 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
  - a. Show roof-mounted items.
  - b. Show wall-mounted items.
4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
  - a. Flashing and trim.
  - b. Gutters.
  - c. Downspouts.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For the following products:
  1. Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
  2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
  3. Accessories: Nominal 12-inch-long Samples for each type of accessory.
- E. Delegated Design Submittals: For metal building systems.
  1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector and manufacturer.
- B. Welding certificates.
- C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
  1. Name and location of Project.
  2. Order number.
  3. Name of manufacturer.
  4. Name of Contractor.
  5. Building dimensions including width, length, height, and roof slope.
  6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
  7. Governing building code and year of edition.
  8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
  9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.

10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

D. Erector Certificates: For qualified erector, from manufacturer.

E. Material Test Reports: For each of the following products:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control reports.

G. Field quality-control reports.

H. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.

I. Sample Warranties: For special warranties.

## 1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes to include in maintenance manuals.

## 1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. Accreditation: Manufacturer's facility accredited according to IAS AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for typical wall metal panel including accessories.
  - a. Size: 48 inches long by 48 inches.

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.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

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

#### 1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

#### 1.12 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Finish Warranty Period: 20 years from date of Substantial Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
  1. Warranty Period: 20 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. All American Systems; a division of NCI Building Systems, Inc.

2. American Buildings Company; a Nucor company.
3. Chief Buildings; Chief Industries, Inc.
4. Dean Steel Buildings, Inc.
5. Gulf States Manufacturers; Nucor Company.
6. Varco Pruden.

- B. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

## 2.2 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type:
  1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
- C. End-Wall Framing:
  1. Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.
- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.
- E. Eave Height: As indicated.
- F. Bay Spacing: As indicated.
- G. Roof Slope: As indicated.

## 2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design metal building system.
- B. Structural Performance: Metal building systems to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
  1. Design Loads: As indicated on Drawings.
  2. Deflection and Drift Limits:
    - a. Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
    - b. No greater than the following:
      - 1) Purlins and Rafters: Vertical deflection of 1/150 of the span.
      - 2) Girts: Horizontal deflection of 1/120 of the span.
      - 3) Metal Roof Panels: Vertical deflection of 1/150 of the span.



- 4) Metal Wall Panels: Horizontal deflection of 1/180 of the span.
  - 5) Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
  - 6) Lateral Drift: Maximum of 1/100 of the building height.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
1. Wind Loads: As indicated on Drawings.
- E. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- F. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- G. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- H. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft.

## 2.4 STRUCTURAL-STEEL FRAMING

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
    - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
  2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
1. Purlins:
    - a. C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch-wide flanges.
    - b. Steel joists of depths indicated on Drawings.
      - 1) Depth: As indicated.
  2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch-wide flanges.
    - a. Depth: As indicated.
  3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
  4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch-diameter, cold-formed structural tubing to stiffen primary-frame flanges.
  5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
  6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch, fabricated from zinc-coated (galvanized) steel sheet.
  7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
  8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
  9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- G. Bracing: Provide adjustable wind bracing as follows:
1. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.

- H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.
- I. Materials:
1. W-Shapes: ASTM A992/A992M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
  2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
  3. Plate and Bar: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
  4. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.
  5. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.
  6. Structural-Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A1008/A1008M, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.
  7. Metallic-Coated Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.
  8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.
    - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.
    - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, SS, Grade 50 or 80; with Class AZ50 coating.
  9. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for primary framing.
  10. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for secondary framing.
  11. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.
    - a. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
  12. High-Strength Bolts, Nuts, and Washers, Grade A325: ASTM F3125/F3125M, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
    - a. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
  13. Unheaded Anchor Rods: ASTM F1554, Grade 55.
    - a. Configuration: Straight.
    - b. **Nuts: ASTM A563 heavy hex carbon steel.**
    - c. Plate Washers: ASTM A36/A36M carbon steel.
    - d. Washers: ASTM F436 hardened carbon steel.

- e. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
- J. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
  - 1. Clean and prepare in accordance with SSPC-SP2.
  - 2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
    - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

## 2.5 INSULATED METAL ROOF PANELS

- A. Metal Roof Panels shall be as follows or equivalent:
  - 1. 4" CFR Insulated Metal Roof Panel
    - a. Exterior Profile with 2" high standing seam with Mesa profile between seams, embossed
    - b. Exterior Face of 24 Ga AZ-55 aluminum-zinc coated steel with acrylic coating
    - c. Interior Profile Mesa, nominal 1/8" deep embossed
    - d. Interior Face of AZ-50 24 Ga aluminum-zinc coated steel
    - e. Insulation shall provide a minimum R value of 35.0

## 2.6 METAL WALL PANELS

- A. Metal Wall Panels shall be as follows or equivalent:
  - 1. 3" CF Striated Insulated Metal Wall Panel
    - a. Exterior Profile with longitudinal striations, nominal 1/32" deep embossed
    - b. Exterior Face of 24 Ga AZ-50 aluminum-zinc coated steel with acrylic coating
    - c. Interior Profile Mesa, nominal 1/16" deep embossed
    - d. Interior Face of AZ-50 24 Ga aluminum-zinc coated steel
    - e. Joint shall be double tongue and groove
    - f. Insulation shall provide a minimum R value of 26.2

## 2.7 METAL SOFFIT PANELS

- A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Concealed-Fastener, Flush-Profile, Metal Soffit Panels: Formed with vertical panel edges and flush surface; with flush joint between panels; with 1-inch-wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps.
  - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

- a. Exterior Finish: Fluoropolymer.
  - b. Color: As selected by Architect from manufacturer's full range.
- 2. Panel Coverage: 12 inches.
- 3. Panel Height: 1 inch.

## 2.8 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
  - 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
  - 2. Clips: Manufacturer's standard, formed from stainless steel sheet, designed to withstand negative-load requirements.
  - 3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  - 4. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
  - 5. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
  - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
- H. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
  2. Fasteners for Metal Wall Panels:
    - a. Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless steel or zinc-alloy-steel hex washer head, with EPDM sealing washers bearing on weather side of metal panels.
  3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
  4. Blind Fasteners: High-strength aluminum or stainless steel rivets.
  5. Corrosion-Resistant 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.
  6. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
  7. Metal Panel Sealants:
    - a. Joint Sealant: ASTM C920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

## 2.9 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members to be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
1. Make shop connections by welding or by using high-strength bolts.
  2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
  3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
  4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
  5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
1. Make shop connections by welding or by using non-high-strength bolts.
  2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

## 2.10 SOURCE QUALITY CONTROL

- A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.
1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.
    - a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
  - 1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

### 3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.



2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
    - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
  2. Locate and space wall girts to suit openings such as doors and windows.
  3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
1. Tighten rod and cable bracing to avoid sag.
  2. Locate interior end-bay bracing only where indicated.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

### 3.4 METAL PANEL INSTALLATION, GENERAL

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- C. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

- a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
  - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
  - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Locate metal panel splices over structural supports with end laps in alignment.
  - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- D. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
- 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- E. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- F. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
- 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

### 3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
- 1. Install ridge and hip caps as metal roof panel work proceeds.
  - 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
- 1. Install clips to supports with self-drilling or self-tapping fasteners.
  - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
  - 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.

5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
  6. Provide metal closures at peaks each side of ridge and hip caps.
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
  2. Shim or otherwise plumb substrates receiving metal wall panels.
  3. When two rows of metal panels are required, lap panels 4 inches minimum.
  4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
  5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
  6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
  7. Install screw fasteners in predrilled holes.
  8. Install flashing and trim as metal wall panel work proceeds.
  9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
  10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
  11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
- C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, noncumulative; level, plumb, and on location lines; and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.7 METAL SOFFIT PANEL INSTALLATION

- A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.
- B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

### 3.8 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  - 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  - 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  - 1. Install exposed flashing and trim 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.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
  - 1. Provide elbows at base of downspouts to direct water away from building.
  - 2. Tie downspouts to underground drainage system indicated.
- E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

### 3.9 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Product will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.

### 3.10 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting:
  - 1. After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
    - a. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
    - b. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
  - 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

## SECTION 13341

### (PEMB) HIGH PERFORMANCE COATING

#### PART 1: GENERAL

##### 1.01 SECTION INCLUDES

- A. Field preparation and application of surface conditioners, primers, and high-performance coating to all metal building steel. Paint shall be applied to all structural members to all sides and faces prior to installation and after delivery. This section does not apply to metal roof panels or metal wall panels.

##### 1.02 QUALITY ASSURANCE

- A. Applicator: Shall be specialized in high performance coating with a minimum five years documented experience and approved by coating manufacturer.
- B. Submit electronic copies of each product data sheet for review prior to the start of work.

##### 1.03 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame/fuel/smoke rating requirements for finishes.

##### 1.04 WARRANTY

- A. Warranty against blistering, peeling or other loss of adhesion, yellowing, excessive chalking and other defects in material.
- B. Duration of coverage shall be for a period of (10) years from date of substantial completion.

##### 1.05 BARRIERS AND ENCLOSURES

- A. Provide to prevent public entry, to protect existing equipment, structures and pipes; to protect existing landscaping; to provide for owner's use of site; to protect existing facilities and adjacent elements from damage and to protect products and finished work as conditions warrant.

##### 1.06 CONSTRUCTION CLEANING

- A. Maintain areas under contractor's control free of waste materials, debris and rubbish.
- B. Remove waste materials, debris and rubbish from site periodically and dispose of off-site, conforming to applicable regulations for disposal of debris.
- C. Maintain disposal area in an orderly manner; prevent run-off into water, surrounding

landscape, or adjacent properties.

#### 1.07 STORAGE AREAS AND SHEDS

- A. CONTRACTOR to suggest storage areas which must be approved by OWNER.
- B. As required for material storage allowing for access, maintenance and inspection of products.

#### 1.08 STORAGE AND PROTECTION

- A. Store products immediately upon delivery, in accordance with manufacturer's recommendations with seals and labels intact.
- B. Protect until used/installed.

#### 1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply high performance coatings during inclement weather, when humidity is above 85% or when air or substrate surface temperature is below manufacturer's recommendations, unless otherwise recommended by manufacturer.

### PART 2: PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. **The Sherwin Williams Company.**
- B. Substitutions: Not allowed.

#### 2.02 MATERIAL SCHEDULE

- A. PRIMER: Two-Component, High-Solids, Fast-Drying Polyamide Epoxy Mastic: **Macropoxy 646**
- B. TOP COAT: Two-Component, Fluoropolymer Urethane Finish: **FluoroKem HS100**

#### 2.02 FINISHES & COLORS

- A. Color of TOP COAT to be selected and approved by OWNER from manufacturer's Color System.

### PART 3: EXECUTION

#### 3.01 INSPECTION

- A. Verify surfaces are ready to receive work as recommended by manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report

any condition that may potentially affect proper application.

- C. Verify substrate moisture content does not exceed manufacturer's recommended "dry" condition.
- D. Beginning of installation means acceptance of existing surfaces.
- E. Periodic inspections of performance are required of the manufacturer. In addition, manufacturer shall conduct pull tests on sample of each coat to verify adhesion to prepared steel and bond between coats.

### 3.02 PREPARATION

#### A. General:

- 1. Perform preparation and cleaning procedures as recommended by manufacturer, and as herein specified, for each particular substrate condition.
- 2. For more detailed information, see manuals and publications of standard industry procedures provided by organizations such as the following:
  - a. American Institute of Architects (AIA)
  - b. Construction Specifications Institute (CSI)
  - c. American Society for Testing and Materials (ASTM)
  - d. National Association of Corrosion Engineers (NACE)
  - e. Steel Structures Painting Council (SSPC)
- 3. Remove or protect items not to be finish painted. After completion of painting in each space or area, reinstall removed items.

### 3 Ferrous Metal:

- 1. Prepare steel to receive primer by removing any loose, not adherent, rust and paint. Mill scale, rust and paint shall be considered adherent if they cannot be removed by lifting with a dull putty knife.
- 2. Apply primer as soon as possible to avoid rust return or recontamination. Do not leave steel uncoated overnight.

### 3.03 PROTECTION

- A. Protect elements, surrounding the work of this Section from damage or disfiguration.
- B. Protect existing mechanical, electrical, processing, plumbing, handrails, equipment, and adjacent structures as necessary to perform the work after cleaning for preparation.
- C. Repair damage to other surfaces caused by Work of this Section.



- D. Furnish drop cloths, shields and protective methods to prevent spray or droppings from disfiguring other surfaces.
- E. Remove empty coating containers from site.

#### 3.04 APPLICATION

- A. Apply products in strict accordance with manufacturer's recommendations.
- B. Do not apply finishes to primed or intermediate coated surfaces that are not dry.
- C. Apply each coat to achieve film thickness as recommended by manufacturer.
- D. Allow applied coat to dry before next coat is applied.

#### 3.05 CLEANING

- A. As work proceeds, promptly remove paint where spilled, splashed or spattered. Use only approved solvent for cleaning.
- B. During progress of work, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.
- C. Collect waste, cloths, and material which may constitute a fire hazard, place in metal containers and remove daily from site.

#### 3.06 APPLICATION NOTES

- A. Finishes should be applied to achieve specified dry film thickness.
- B. Spread rates available on technical data sheets and product labels should be used as a guideline for material estimates.
- C. It is the responsibility of the applicator to determine spread rates based on surface textures, profiles, and porosity after required preparation.
- D. The CONTRACTOR shall also be responsible for determining the number of finish coats to provide satisfactory hide and coverage without compromising the finish and performance characteristics of the products.

#### 3.07 COATING SCHEDULE

- A. Blast Cleaned Metal:
  - 1. First Coat: **Macropoxy 646** applied to achieve 5.0 to 10.0 dry mils.
  - 2. Intermediate Coat: **FluoroKem HS 100** to achieve 2.0 to 3.0 dry mils.
  - 3. Finish Coat: **FluoroKem HS 100** to achieve 2.0 to 3.0 dry mils.

**END OF SECTION**

SECTION 13342  
(PEMB) BUILDING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Under slabs-on-grade insulation.
  - 2. Foundation edge insulation.
  - 3. Foam-plastic board insulation.
  - 4. Glass-fiber blanket insulation.
  - 5. Vapor retarders.

1.02 ACTION SUBMITTALS

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

1.03 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research/evaluation reports.

PART 2 - PRODUCTS

2.01 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84. For foundation edge and under slab-on-grade insulation – 2 inches thick, unless indicated otherwise.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. DiversiFoam Products.
    - b. Dow Chemical Company (The).
    - c. Owens Corning.

d. Pactiv Building Products.

2. Type IV, 25 psi (173 kPa), unless otherwise indicated.

## 2.02 POLYISOCYANURATE BOARD INSULATION

A. Rigid Polyisocyanurate Board Insulation: Cellular thermal insulation with glass fiber-reinforced Polyisocyanurate closed-cell foam core and aluminum foil facing laminated to both sides: complying with FS HH-I-1972/1, Class 2; aged r-values of 7.2 and 8 at 40 and 75 degrees F (4.4 and 23.9 degrees C), respectively, and as follows:

1. Surface Burning Characteristics: Maximum values for flame spread and smoke developed of 20 and 150, respectively.

## 2.03 GLASS-FIBER BLANKET INSULATION

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

1. CertainTeed Corporation.

2. Guardian Building Products, Inc.

3. Johns Manville.

4. Knauf Insulation.

5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

## 2.04 UNDERSLAB VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM E 1745 Class A, 10 mils (0.25 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

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

### 3.02 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
  - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
  - 1. If not otherwise indicated, extend insulation full thickness a minimum of 4'-0" in from the outside edge of slab-on-grade. Cut and fit tightly around obstructions and fill voids with insulation.
  - 2. Protect top surfaces of horizontal insulation (from damage during concrete work) by application of protection board.

### 3.03 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.

- C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

#### 3.04 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- C. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

END OF SECTION

## SECTION 13410

### BASIC INSTRUMENTATION REQUIREMENTS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: General administrative and procedural requirements for instrumentation installations. Administrative and procedural requirements are included in this Section to expand on requirements specified in Division 1.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Sections 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product data for each product specified.
  - 2. Wiring diagrams, both elementary and schematic, differentiating between manufacturer installed and field-installed wiring.
  - 3. Digital Systems: Provide the following:
    - a. Digital equipment layouts of input and output racks showing complete module model number and addressing assignment. Layouts of port pin assignment, connection schematic indicating cable types and port addresses.
  - 4. Software Programs: One fully annotated printed copy of program prior to factory test. In addition, provide required number of copies of latest revisions of program at time of acceptance by OWNER. Submittal of printouts, listings, and screen images shall be supplied on paper (hard copy). With concurrence of OWNER and ENGINEER, machine readable magnetic copies may be supplied in addition to printed copies as a matter of convenience. Format of magnetic media shall be as mutually agreed with OWNER.
  - 5. Programmable Logic Controllers: Submits lists of input and output assignments, data file structures used, and internal data points. Show points used to communicate with between PLCs and the operator interface and data collection segments. Include complete, fully annotated ladder logic diagrams complete with cross-reference listings.
  - 6. Operator Interface and Supervisory Control: Submit "screen dump" images of each proposed operator interface screen. Describe color schema, mouse button use, function key controls and communication protocol with PLCs. Provide a flow diagram showing screen navigation. Show sample event and alarm log outputs.

7. Data Collection: Submit details of data structures, communications protocols, data exchange formats, sampling intervals, and file storage space management. Provide "screen dump" images of historical trending.
  8. Data Management and Reporting: Includes process data management, laboratory management, and reporting. Submit data definitions, customization of base software, data entry screens, menus, and report formats. Describe data entry, collection, and reporting scenarios. Describe data file storage management including backup and archive operations.
- B. Record Drawings: At Project closeout, submit record drawings of installed products, in accordance with requirements of Section 01720.
1. Where Drawings are drafted by computer equipment, CONTRACTOR shall furnish files on a disk. These Drawings shall include changes made by Field Orders, Change Orders, Addenda, and errors discovered during start-up and acceptance.
  2. Drawings shall include terminal numbers at each wiring termination and piping termination. A complete system diagram shall be included.
- C. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01730, operation and maintenance manuals for items included under this Section.
1. Instructions shall be short, easy-to-understand directions specifically written for this Project describing various possible methods of operating equipment. Instructions shall include procedures for tests required, adjustments to be made, and safety precautions to be taken with equipment. These documents are to be submitted to ENGINEER's office.
  2. Provide 1 complete set of manufacturer's documentation covering programmable equipment supplied. Include hardware manuals and prints as manufacturer normally ships with programmable equipment.
    - a. Include complete software manuals for operating system, as well as manuals for any other software. Written instructions for the operations and maintenance of software shall be provided. The instructions shall be short, easy-to-understand directions specifically written for this Project describing various possible methods of operating software.
    - b. Include program listings, point/address lists, cross-reference listings, images of screens, data entry forms, and sample reports.
    - c. Manuals shall include instructions for program users and instructions for maintenance programmers.
- D. Warranty: Submit in accordance with requirements of Section 01740, warranties covering the items included under this Section.
1. Warranty time periods shall start from Start-up date and not ship dates.



### 1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of equipment, of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
  - 1. National Electric Code.
  - 2. Applicable State and local requirements.
  - 3. UL listing and labeling shall be adhered to.
- C. Items covered by this Section are designated as undelivered specifically manufactured equipment for which associated progress payments will be made in accordance with this Specification.
- D. Equipment that does not have a UL, FM, CSA, or other listed testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that equipment furnished has been manufactured in accordance with National Electric Code and OSHA requirements.
- E. CONTRACTOR shall provide permits and licenses, observe and abide by applicable laws, regulations, ordinances, and rules of State, territory or political subdivision thereof, wherein the Work is done. CONTRACTOR shall pay fees for permits, inspections, licenses, and certifications when such fees are required.
- F. To ensure timely performance and conformance with Specifications, Project meetings shall be held at OWNER's facility once every 3 months during course of Project. Cost of such meetings shall be included.
- G. Calibration Equipment and Testing Apparatus: Equipment supplier shall have available test and calibration equipment for factory panel tests, installation, start-up, service contract, and maintenance or troubleshooting purposes.
  - 1. The equipment required for these tests is as follows:
    - a. One - Digital Multimeter with an accuracy of plus or minus 0.1 percent.
    - b. One - Signal calibrator for analog signals.
    - c. One - 60-inch Water Manometer with 0.1-inch graduations. Include accessories of floor stand, pipe clamp, tubings, air bulb with shutoff and fittings for 0.25 inch and 0.375 inch threaded taps for "Tee" fittings to connect manometer.

- d. One - 20-inch Mercury Manometer graduated in inches of water. Include accessories of floor stand, pipe clamp, tubing, air bulb with shutoff and fittings for 0.25 inch and 0.375 inch threaded taps and "Tee" fittings to connect manometer.
  - e. One - 0 to 100 psi, 6-inch-diameter pressure gauge with 1 psi graduations and plus or minus 1 percent accuracy. Include "Tee" fittings and fittings for 0.25 inch through 1 inch threaded taps to connect gauge.
  - f. One - Air tank pressurized to 150 psi with 2 regulators. One regulator for the 0 to 30 psi range, and one regulator for the 30 to 100 psi range. Include accessories of fittings for 0.25 inch through 1 inch threaded taps to connect air tank.
  - g. One - 30-foot supply of 0.375-inch PVC clear plastic tubing with fittings for 0.25 inch and 0.375 inch threaded taps to make manometers for Venturi tubes, orifice plates, etc., for calibration checks.
  - h. One - Decibel meter for telemetry work capable of reading minus 40 db to plus 10 db over frequency range of 300 to 2,500 hertz with a selective narrow band filter.
  - i. One - High-impedance earplug speaker with alligator clips for telemetry monitoring of transmitter keying.
  - j. One - Signal generator for telemetry adjustable over 300 to 2,500 hertz with 1 milliwatt output into 600 ohm line.
  - k. One - Set of portable radios capable of operating within buildings at one location and 5 miles outside of buildings in hilly terrain.
  - l. One - Programming terminal with software to configure programmable equipment.
- H. Component Requirements: For the purposes of uniformity and conformance to industry standards, signal transmission modes shall be either electronic 4-20 mA DC or pneumatic 3-15 psi only. No other signal characteristics are acceptable, except for remote temperature detector (RTD) and thermocouple (TC) sensing circuits; 4-20 mA DC signals shall be such that devices may be wired in parallel for 1-5 volt DC as required. 1-5 volt DC mode shall be employed only within control panel enclosures.
- I. Responsibility and Coordination: Drawings and Specifications are intended to include details of a complete equipment installation for purposes specified. CONTRACTOR shall be responsible for details which may be necessary to properly install, adjust, and place in operation complete installation. Any error on Drawings or in Specifications which prevents proper operation of supplied system shall be shown correct at time of Shop Drawing submittal for approval or brought to attention of ENGINEER with or prior to submittal.

- J. CONTRACTOR shall be responsible for costs incurred to correct aforementioned errors brought to ENGINEER's attention. CONTRACTOR shall assume full responsibility for additional costs which may result from unauthorized deviations from Specifications.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Manufactured material shall be adequately packed to prevent damage during shipping, handling, storage, and erection. Material shipped to Site shall be packed in a container properly marked for identification. Blocks and padding shall be used to prevent movement.
- B. CONTRACTOR shall inspect the material prior to removing it from carrier. If damage is observed, CONTRACTOR shall immediately notify carrier so that a claim can be made. If no such notice is given, material shall be assumed to be in undamaged condition; any subsequent damage that occurs to the equipment shall be the responsibility of CONTRACTOR. Repair and replacement of damaged parts will be done at no expense to OWNER.
- C. CONTRACTOR shall be responsible for any damage charges resulting from handling of materials.

### PART 2 - PRODUCTS

#### 2.01 EQUIPMENT SUPPLIERS

- A. Subject to compliance with specified requirements, equipment suppliers shall be the following (no "or equals"):
  - 1. N/A
- B. References made in these Specifications to specific manufacturer's products are intended to serve as a guide to type, construction, and materials. Listing of a manufacturer does not imply acceptance by ENGINEER of a manufacturer's particular product, product line, or latest product revision if it does not meet Specifications.
- C. Equipment Supplier: Equipment specified under Sections 13413 through 13899 and shown on Drawings shall be designed as a system, fabricated or purchased, shipped to Site, and started up by one of the qualified and approved equipment suppliers listed under this Section. Intent is for unit responsibility.
  - 1. Equipment supplier shall not assign any of its rights or delegate any of its obligations under these Sections without prior written acceptance by ENGINEER.
  - 2. Direct purchase of any items in these Sections by CONTRACTOR is not in compliance with this Specification and will not be permitted.

3. When a Service Contract is included, it shall be performed by factory-trained personnel employed by equipment supplier. Equipment supplier shall assign a qualified Engineer employed by the supplier as Project Engineer/Project Manager.
  - a. Project Engineer/Project Manager's name shall be forwarded to CONTRACTOR and ENGINEER within 30 days after receipt of a purchase order by equipment supplier.
  - b. Project Engineer/Project Manager shall be focal point for design, fabrication, Contract communications, and shall be responsible for start-up and acceptance. Project Engineer/Project Manager shall be at factory test at Site for start-up and at the Site during entire acceptance procedure. Only qualified and approved equipment suppliers shall be accepted as meeting this Specification.

## 2.02 EQUIPMENT

- A. Transmitted electronic signals to equipment of other vendors and between control panels shall be a separate isolated-floating output for each item of equipment and shall conform to ISA Standard S50.1.
- B. Enclosures shall be NEMA 1, 4, 4X, or 7 as indicated on Drawings. Intrinsically safe systems, as approved by Factory Mutual, shall be furnished when called for.
- C. No external power connections shall be allowed unless specifically called for in Specification. Where an external power source is called for, unit shall accept 120 VAC, plus or minus 10 percent power.
- D. Current-to-current converters shall be used as power boosters to provide sufficient signal power as required. It is equipment supplier's responsibility to determine under what circumstances and locations power boosters are required, provide them, and integrate them into the instrumentation system to make system function properly.
- E. Separate power supplies shall be totally enclosed with solderless terminals for connections. They shall be short circuit current limiting type that will automatically resume regulation after removal of short circuit. They shall operate from 120 volt AC, plus or minus 10 percent power. Regulated voltage shall be fixed. Units with internal trim potentiometers will be accepted.
  1. Pneumatic instruments shall have an input and output range of 3-15 psig. Units shall require a 20 psi supply. Provide an air set for each pneumatic unit or for each 20 psi manifold. Bubbler air sets, regulators, valves, etc., must be factory assembled on a subplate as specified and detailed.
  2. Instruments shall be panel-mounted or enclosed for wall mounting as shown on Drawings.

- F. Size and style of instruments are defined in Specifications. Pneumatic panel-mounted units shall match in appearance similar electronic components.
- G. Charts and scales are shown on Drawings. Standard scales shall not be accepted without ENGINEER's approval if it differs from those shown. Ratio station scales and other scales shall be graduated such that major graduations fall on whole numbers (i.e., 1, 2, 3, or 5, 10, 15, etc.) and minor graduations fall on 0.1 or 0.2 intervals (i.e., 1.1, 1.2 or 11, 12, etc.). If two scales are called for on ratio stations, each scale shall be indexed to meet Specification. Drawing of each scale for ratio stations shall be submitted with Shop Drawings for approval.
- H. Solid-state output switches, where used, shall be overvoltage transient protected and not be damaged by  $di/dt$  or  $dv/dt$  for their design application under this Contract.
- I. Instruments shall be equipped with permanently attached identification tag. Tag shall be included on field- and panel-mounted devices. Tags shall include ENGINEER's tag identification and manufacturer's tag identification if different from ENGINEER's.
  - 1. Tags shall be either stamped metal or laminated phenolic with white letters engraved on a black background. Field-mounted devices shall have tags fastened with screws. Devices mounted in panels will be tagged inside panel on subplates or on device itself where it can be easily read.
- J. Finish on instruments and accessories shall provide protection against corrosion by elements in environment in which they are to be installed. Both the interior and exterior of enclosures shall be finished. Extra paint of each color used on material shall be provided by manufacturer for touch-up purposes.
- K. Provide equipment identification nameplates complying with Section 16075. Nameplates shall contain ENGINEER's item designation and, for indicators and transmitters, design range and units of device shown.

## 2.03 SOURCE QUALITY CONTROL

- A. Control and monitoring system control panels and computer equipment, if any, shall be tested at the factory and witnessed by ENGINEER prior to shipment to Site. ENGINEER shall be given 4 weeks notice before factory test date. Factory test shall include checking for conformity to Specifications, fabrication, and nomenclature. Control and monitoring system logic and terminals shall be checked line by line and function by function in total for conformity of Drawings.
- B. Conduct preliminary testing prior to factory checkout by executing programs supplied for this Project. Exercise inputs to test logic for correct function and proper response of outputs. Verify correct interface with programs. Verify correct communications.
- C. Factory testing shall be used to validate fieldbus and plant LAN/WAN interconnections. Proper communication between devices and software components shall be demonstrated. Data Collection and Data Management Reporting shall be demonstrated.

- D. Equipment supplier shall have test equipment available at the factory. A full set of annotated logic programs and wiring diagrams with the latest revisions shall be made available to ENGINEER at factory for checking purposes. Drawings shall include wire numbers and terminal numbers.
- E. Control panels and programmable equipment shall not be shipped to Site until logic conforms to Contract requirements, physical changes required by testing are made, and tags conform to factory test corrections. Equipment delivered to Site without factory test or corrections will be returned to factory at CONTRACTOR's expense.

#### 2.04 SOURCE QUALITY CONTROL

- A. PLCs, local operator computers, data management computers, and associated control panels shall be tested at the factory prior to shipment to the Site. ENGINEER is to be given 4 weeks notice before the factory test date; ENGINEER will witness the tests. The purpose of factory testing is to verify correct functioning of equipment and conformity to Project requirements before shipment. A factory representative of the programmable equipment shall be at the factory checkout to certify that device switch settings have been properly set and the system is communicating properly.
- B. The equipment supplier shall make available 1 qualified person for entire duration of the factory test. This includes equipment supplier factory testing witnessed by ENGINEER, and during the software checkout phase of the factory test listed below.
- C. The factory checkout for the programmable logic controller shall be capable of being tested as a complete system, over telephone lines from ENGINEER's office in Ann Arbor, Michigan, to equipment supplier's factory. A dedicated phone line and adequate furniture shall be located adjacent to the control panels for use by ENGINEER for the duration of the factory test.
- D. Once the PLCs, etc., are connected at the equipment supplier's factory, and it has been demonstrated that the equipment properly communicates, the panels shall remain at the supplier's facility for 4 additional weeks to allow ENGINEER to check out the PLC software and operator interface software.
- E. Test Procedures:
  - 1. Hardware testing to verify system wiring, layout, workmanship, and appearance. Demonstrate correct function of inputs and outputs using a switch and lamp "mimic board." Perform a PLC load test to verify that outputs can be driven at full load simultaneously.
  - 2. Communications tests to verify inter-processor messaging via data highway, serial links, data management computer, and modems.
  - 3. Control logic tests begin with loading ENGINEER-developed ladder logic software. Control logic and sequences shall be tested and verified using a switch and lamp "mimic board."

- 4. Operator interface integration test builds upon previously completed phases by exercising entire system from the data management computer.
- F. At completion of tests, system shall remain intact for a period of at least 4 weeks for ENGINEER's use correcting software errors found during the course of test.
- G. Schedule factory test not before 20 weeks after Shop Drawing status of deliverable items under this Section is either N.E.T. or F.A.C.
- H. Provide services of PLC manufacturer's application engineer at factory test for 4 days.
- I. CONTRACTOR shall include in his Bid an amount, when the instrumentation system factory test facility in this Section is more than 80 miles from ENGINEER's Ann Arbor, Michigan office. CONTRACTOR shall pay transportation for weekly trips and lodging costs for 2 members of ENGINEER's staff over entire factory test.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Equipment provided under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions, and recommendations of equipment manufacturer as approved by ENGINEER.
- B. Install equipment as indicated, in accordance with manufacturer's written instruction, and in compliance with recognized industry practices to ensure that products fulfill requirements.
- C. Elements that are supported by plumbing or piping, or that have only plumbing or piping connections shall be installed under those Sections.
- D. Plumbing, piping, or pneumatic signal connections to elements requiring such connections shall be made under those Sections. Control panels shall be installed in accordance with Division 16 Sections, with piping connections to control panels installed under Division 15 Sections.
- E. Drawings are not intended to show every detail of construction or location of piping, ductwork, or equipment. Where proper operation or construction makes it necessary or advisable to change location of piping, instrumentation equipment, air ducts, or other equipment, CONTRACTOR shall so inform ENGINEER for his approval and permission.

#### 3.02 FIELD QUALITY CONTROL

- A. Calibrate equipment in accordance with manufacturer's instructions to ranges or set points indicated on Drawings.

- B. Installation and Start-up: Equipment supplier shall have an established service facility from which qualified technical service personnel and parts may be dispatched upon call. Such a service facility shall be no more than 6 hours travel time from Site.
  - 1. Equipment supplier shall provide an experienced, factory-trained, competent, and authorized service representative for a minimum of 3 times at Site, including once during installation and start-up and once during acceptance to inspect, check, and calibrate any part of system. Supplier's service representative shall revisit Site for 8 hours per day as often as necessary after installation until trouble is corrected and equipment has passed acceptance test and is operating satisfactorily to ENGINEER.
  - 2. Third trip is after equipment has been accepted and shall be used to instruct OWNER's personnel in aspects of operation and maintenance, such as fuse locations, use of controls, instruction manuals, etc. Third trip shall be for duration of two, 8-hour days at OWNER's facility.
- C. Equipment supplier shall provide two, 8-hour days of training for OWNER's personnel in aspects of operation and maintenance such as use of controls, fuse locations, instruction manuals, etc.
  - 1. Training and instructions at the plant shall be given by the Project Engineer assigned to the Project by the equipment supplier or other personnel as approved by ENGINEER.
- D. Digital Equipment Field Training: At conclusion of field acceptance tests, CONTRACTOR shall conduct a training course for OWNER's personnel in use of system.
  - 1. Course shall be 2 weeks duration and shall consist of hands-on use of system as well as lectures.
  - 2. Written course materials shall be provided to each participant for use during instruction and to serve as a basic reference document after training.

### 3.03 TRAINING

- A. Digital Equipment: Equipment supplier shall provide comprehensive instruction for the programmable controller, operator interface, computers, and software packages supplied. This instruction shall be performed by manufacturer of the products at their factory training facility. Equipment supplier shall submit to ENGINEER an outline of the proposed training courses to meet the requirements set forth below. Equipment supplier shall also provide to ENGINEER a list of additional courses available from manufacturer. Upon review, ENGINEER may request that a substitution be made of a course content that better fits the needs of OWNER. Such substitution shall only be requested for courses of equal length, cost, and availability. The content of these courses and proposed lengths shall be as follows:



1. Programmable Logic Controller Training (x individuals - x trips):
  - a. Rockwell Courses:
    - 1) PLC-5 Maintenance and Troubleshooting 4 days
    - 2) PLC-500 Maintenance and Troubleshooting 3 days
    - 3) Maintenance and Troubleshooting a Logix 5000 System 4 days
2. Operator Interface Computer-Network File Server (x individuals - x trips):
  - a. Supporting Windows NT Server 5 days
  - b. Supporting Windows NT Workstation 5 days
3. SCADA Software (x individuals - x trips):
  - a. Wonderware Training Courses:
    - 1) Intouch Maintenance 2 days
  - b. Intellution Training:
    - 1) iFIX Fundamentals Plus 254 4 days
4. Plant Operation and Maintenance Software (x individuals - x trips):
  - a. DataStream Training:
    - 1) MP2 Essentials 5 days
5. General Use Software (x individuals - x trips):
  - a. Using Microsoft Word 1 day
  - b. Using Microsoft Excel 1 day
  - c. Using Microsoft Access 2 days

- B. CONTRACTOR shall bear transportation and subsistence costs for the specified training. The cost shall include per diem allowance of \$150 per day per person. CONTRACTOR shall arrange for training for OWNER with a minimum of 6-week notification of the training schedule prior to the actual course being provided. Scheduling of the courses and their contents shall be approved by ENGINEER and provided at a time and location agreeable to OWNER. The course shall be conducted at locations normally established for such courses by manufacturers of the software and computer products.

#### 3.04 DEMONSTRATION

- A. Upon completion of installation and calibration, demonstrate functioning of equipment in accordance with requirements. Where possible, correct malfunctioning units at Site, then retest to demonstrate compliance; otherwise, remove and replace with new or repaired units, and retest to demonstrate compliance.

END OF SECTION

## SECTION 13421

### FLOW MEASUREMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Magnetic flow meter.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with General Conditions covering the items included under this Section.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Magnetic Flow Meter:
    - a. Endress+Hauser Proline Promag W 500

##### 2.02 MAGNETIC FLOW METER

- A. Magnetic flow meters shall be either flanged as indicated.
- B. Meter body shall be Schedule 10, 304 stainless steel with 150-pound ANSI flange or AWWA Class D flange when ANSI is not an available option.
  - 1. Meters shall have 316 SS/Teflon or polyurethane liner electrodes.
- C. Liner material shall be suitable for the process flow indicated on Drawings.
  - 1. Teflon liner shall be furnished for meters.
- D. Electrodes shall be suitable for the process flow indicated on the drawings and shall be bullet nosed style made of 316 SS.

- E. Start-up and acceptance check for flow meters shall be performed by a qualified employee of flow meter manufacturer. Service personnel of sales representative or of equipment supplier of this Section will not be accepted.
- F. Meter below grade or larger than 10 inches shall be capable of withstanding continuous submergence in up to 30 feet of water without damage. Meters 10 inches or smaller shall be capable of accidental submergence in 30 feet of water for up to 48 hours. Field coil design shall be such that they shall not overheat or otherwise be damaged if flow tube is not totally filled with fluid. Magmeters shall be provided with 2 grounding rings.
- G. The sensing element shall be constructed of suitable materials to withstand submergence to 30 feet to IP 68 rating indefinitely. The tube shall be designed so that it may be buried to a depth of 15 feet where applicable. Provide evidence of ability to be buried. Directions for installation of conduit and wiring connections shall be clearly written and graphically shown for Installer's use.
- H. Magnetic flow meter signal converter shall consist of solid-state, feedback-type microprocessor circuitry. Operational parameters shall be user configurable locally via an integral push-button arrangement or via a remote intelligent terminal. Appurtenances, including hand-held programmer and/or programming software, shall be provided for local configuration of operational parameters. Converter shall change a low-level flow signal from sensor electrodes into an ethernet signal. The converter shall have an extremely high input impedance and not be affected by quadrature noise. The unit shall be capable of accommodating uni-directional or bi-directional flow. Sensing of meter failure shall activate a user-configurable zero or 130 percent output signal and a failure alarm contact closure.
- I. Where indicated on Drawings, a high-frequency digital proportional output shall be provided for use with high-accuracy totalizers. To eliminate errors, the converter shall incorporate an integral zero return circuit to provide a constant zero output signal in response to an external dry contact closure. An automatic empty pipe detector and low-flow cutoff shall be provided as standard.
- J. Magmeter shall be electronically isolated for grounding. Where insulated or nonconductive pipe is used, only orifice plate-type grounding rings will be acceptable. Grounding electrodes which penetrate the liner will not be acceptable.
- K. Unit shall be supplied with an integral or local conduit-mounted flow indicator calibrated in engineering units. Indicator shall be tagged showing design range in units being measured and shall be capable of simultaneously displaying flow rate and totalization with an alphanumeric display.
- L. Zero stability shall be achieved by pulsing the sensing head magnetic field coils with a regulated direct current, first in one direction and then in opposite direction.
- M. Continuous zero stability shall be obtained by signal sampling during the quiescent coil states. There shall be no zero offset or zero adjustments required. The converter shall not require calibration over its expected life under normal use.

- N. Flow meter shall operate within Specifications on 120 volt AC plus 10 percent and 60 hertz plus 5 percent. Power consumption shall not exceed 25 VA for meters 24 inches and smaller, and 50 VA for meters 30 inches or greater.
- O. Input span shall be adjustable between 0-1 and 0-30 feet per second and range adjustment shall be digital. Converter shall include adjustable damping circuitry. Unit shall not be affected by power line aberrations such as those produced by SCR-type motor controllers or other voltage transients.
- P. System accuracy, including primary magnetic flow meter, shall be plus 0.5 percent of rate for maximum flow velocities from 1.33 to 33.33 feet per second, and plus 1 percent of rate for maximum flow velocities from 0.7 to 1.32 feet per second. Repeatability shall be plus 0.1 percent of span. Rangeability shall meet or exceed 30:1 turndown.
- Q. The signal converter portion of the magnetic flow meter shall include both a magnetic driver to power the magnetic coils and the signal converter electronics. The converter shall have the ability to be either integrally or remotely mounted as specified. If not specified, converter shall be remotely mounted. It shall be housed in a NEMA 4X case. When remotely mounted, the signal cable shall be provided with the proper length.
- R. Magmeter manufacturer shall comply with ISO9000 Standards and the meter shall be FM approved. Signal converters shall be interchangeable without effect of meter accuracy or the need for recalibration for all meter sizes. Provide spool-piece for meters sized 12 inches and smaller.

## PART 3 - EXECUTION

### 3.01 GENERAL

NOT USED

END OF SECTION

## SECTION 13600

### FIELD TESTING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. This section describes the requirements for field-testing equipment supplied under Section 13410 Basic Instrumentation Requirements and demonstrating the complete integration of the work.
- B. Furnish test equipment required to perform the testing specified herein. This test equipment may either be owned or leased and is not a part of the equipment furnished to the Owner under this Contract.
- C. Pretest equipment and wiring before beginning any formal field tests. Document pretest results.

##### 1.02 SUBMITTALS

- A. Include test procedures, coordination/scheduling issues, and sign-off forms for each of the following tests:
  - 1. Loop Tests.
  - 2. Control Loop Tuning.
  - 3. Function Tests.
  - 4. Control Strategy Tests.
  - 5. Integrated System Tests.
- B. With initial test procedure submittal, include a proposed schedule outline which indicates how tests will be scheduled within specific subsystems or type, how coordination issues for each subsystem or type of test affect the proposed schedule, duration of tests, and any constraints between tasks or tests. Include time for mobilization of test personnel, set-up for each type of test or subsystem as applicable, and coordination meetings with construction manager. Include a written description or list of all field wiring required to be terminated and labeled for each subsystem or type of tests including whether panel end, equipment end, or both is required to be terminated and labeled before test.
- C. After testing, submit the completed test sign-off forms within ten days.

- D. Document loop checks on the loop drawings and submit to the Engineer. Include the following:
1. Type of test(s) performed.
  2. Date tested.
  3. Problem description, if any.
  4. Signature of tester and date.
  5. Signature of Engineer and date.
  6. Attach additional sheets to the loop drawings as needed to document resolution of issues raised during the test.
- E. Submit loop tuning documentation to the Engineer which includes:
1. Loop number and description.
  2. Problem description, if any.
  3. Signature of tester and date.
  4. Signature of Engineer and date.
- F. Document strategy tests and submit to the Engineer. Include the following:
1. Strategy identification.
  2. Tests performed.
  3. Logic which could not be tested.
  4. Copies of messages, displays and trends which verify operation.
  5. Problem description, if any.
  6. Signature of tester and date.
  7. Signature of Engineer and date.
- G. Document function tests and submit to the Engineer. Include the following:
1. Description of function.
  2. Tests performed.
  3. Copies of messages, displays, reports, and trends which verify operation.

4. Problem description, if any.
  5. Signature of tester and date.
  6. Signature of Engineer and date.
- H. Submit separately test results which indicate failure and need to be retested. Indicate reason for failure, proposed date for retesting, and overall schedule impacts if any.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Pretest loops and wiring prior to formal field testing. Provide complete documentation describing results of pre-testing. Clearly indicate that loops have been pre-tested, along with descriptions of any problems encountered. Perform no formal field testing until pre-tests have been completed.
- B. Conduct field tests in the presence of the Owner or Engineer, except when advised by the Engineer that test witness presence will not be necessary.
- C. If a test, or a portion of a test, fails to the point where it needs to be rescheduled at a later date, re-testing shall be required at no additional cost to the Owner and no extension of the Contract completion date.
- D. Perform field testing to verify the operation of the control system. Perform field testing sequentially and organize by plant area and by unit process within each area. Field tests are as follows:
  1. Loop tests.
  2. Loop tuning.
  3. Control strategy tests.
  4. Function tests.
  5. Integrated system test.
- E. Test each major subsystem. A subsystem is an integrated, fully operational subset of the control system and includes the following:
  1. Programmable Logic Controller (PLC) and associated I/O.
  2. Network communications equipment required for operation of the subsystem.



3. Field instruments, panels, termination cabinets, control devices and related interconnections provided for the plant area.
  4. Operator interface and graphics added and integrated into the existing Plant Control System.
- F. Meet the following conditions prior to the start of any testing:
1. Correct deficiencies noted during unwitnessed in-factory testing.
  2. Have documentation on-site pertinent to the part of the system being tested.
  3. Have on-site, labeled, and properly stored, spare parts, expendables and test equipment pertinent to the part of the system being tested.
  4. Have Engineer approved test schedules and test procedures.
- G. Schedule field testing through the Construction Manager and the Owner on a daily basis.
1. The Owner may redirect testing from one-unit process to another. Make no claim for delay or additional costs for testing if the testing effort is redirected to a different unit process provided the following conditions are met:
    - a. The redirection does not cause more than one-hour interruption to the testing to move test equipment and test personnel to the new unit process.
    - b. There is no change in the amount of test equipment or personnel requirements.
    - c. The redirection is not arbitrary. Process operational constraints, personnel availability, and other's work are valid reasons for redirection.
    - d. The redirection does not occur more than once in any workday subsequent to the daily scheduling meeting.
  2. Perform no testing that may affect plant operation without Owner concurrence.
  3. Perform testing on a per site basis. Test no more than one site at any given time.
- H. Perform tests by following the operation and maintenance manuals word-for-word unless approved otherwise by the Engineer. Lack of complete, detailed manuals will be cause for declaring the test to have failed regardless of the actual test results.
- I. Begin testing by performing the following steps:
1. Check equipment against shop drawing lists.
  2. Verify that the equipment has been installed in accordance with Contract documents and manufacturer's directions.

3. Power up the equipment and run diagnostics to verify error-free operation.
  4. Load software.
- J. Make available for Owner's use loops and control strategies that have been verified to operate properly immediately subsequent to conclusion of the respective test.
- K. The Owner and/or Engineer may participate in testing activities at the Owner's discretion.
1. This participation will serve as a learning experience for plant operations and maintenance personnel but does not take the place of specified training.
  2. This participation does not relieve the Contractor from the specified requirements for testing.
  3. Recognize and adjust for Owner involvement in developing test procedures and schedules.
  4. Owner participation and use will be such that it does not adversely affect specified testing requirements. Make no claim for delay unless the following conditions are met:
    - a. The Owner and the Engineer are notified verbally that Owner actions could cause delay if continued.
    - b. The Owner persists in the delay action.
    - c. Submit written documentation within 24-hours which describes the Owner action and the impact.

### 3.02 LOOP TESTS

- A. Verify field wiring continuity from field device to PLC Panel termination.
- B. Check each loop from the end element to the respective Operator Workstation control display. Include instruments, field wiring, control devices, panels, termination cabinets, input/output cards and other devices in the loop to ensure proper operation and linkage to control station displays.
- C. Test operation of the final control element through panels and through control stations. If a final control element is out of service or not released by the Owner for testing, simulate operation at the final control element location.
- D. For loops found to contain defective or inoperable equipment perform the following:
1. Correct and recheck these loops when equipment is operable.
  2. The Engineer will assist in coordinating the correction of defective work by others.
  3. Do not perform additional checkout work unless directed by the Engineer.

- E. Verify scaling of all devices from minimum to maximum output/range.
- F. Document all debugging issues, fix until the operation is satisfactory, verify and obtain approval of the Engineer/ OWNER.

### 3.03 CONTROL LOOP TUNING TESTS

- A. Complete loop checkout and problem correction prior to loop testing.
- B. Tune regulatory control loops to produce stable control. Use a loop tuning software program to document loop performance.
  - 1. For conventional control loops for PI and PID control, use minimum ITAE (Integral of Time and Absolute Error) criteria with overshoot constrained to 10 percent unless otherwise directed by the Engineer.
  - 2. Provide reduced gains or filtering to minimize unnecessary output activity to electric actuators as directed by the Engineer.
  - 3. Adjust input scan time or time intervals between controller calculations as necessary to produce stable control.
  - 4. Tune cascaded controllers similar to the above with the inner loop tuned first while the outer loop is off or inactive.
- C. Derive initial tuning parameters from open loop tests. Make final tuning parameter adjustments based on closed loop tests.
- D. Operate tuned loops for a minimum of 24 hours prior to control strategy testing.

### 3.04 CONTROL STRATEGY TESTS

- A. Submit Control Strategy Test Plan for approval and use during test. Documentation shall include a sequence of all tests for each equipment individually and a overall startup and shut down operation. Upon approval of the test plan, schedule with Engineer and Owner for conducting the Control Strategy Test at site.
- B. Fully test control strategies to ensure specified operation. Include the following:
  - 1. Sequences.
  - 2. Alternate control modes.
  - 3. Dynamic gain adjustments.
  - 4. Contingency responses to device failures, where possible.
  - 5. Display and keyboard interaction.
  - 6. Messages.

- C. Prior to use on the process equipment, compare strategies with approved submittals to verify that as-built linkages and logic agree with the documentation. Note and correct discrepancies.
- D. Test as much of the logic as possible for process equipment. It may not be possible to test all logic due to operational constraints.
- E. Annotate changes made during testing on the documentation to reflect final as-built conditions.

### 3.05 FUNCTION TESTS

- A. Test functions of subsystems to verify that the subsystem has been installed and is operational. Test functions that apply to the subsystem being tested.
- B. Fully test operator station functions. Include the following:
  - 1. Process control displays and linkages.
  - 2. User entry functions.
  - 3. Alarm and event handling. Generate or simulate alarm conditions to test.
  - 4. Other specified functions for the stations.
- C. Test data handling and access functions. Use live data and include the following:
  - 1. Plant-wide database.
  - 2. Historical data collection and storage, retrieval and correction at both SCADA Servers.
  - 3. Historical trending.
  - 4. Report generation and printing.
  - 5. Other specified data handling functions.
- D. Demonstrate the following support and maintenance functions:
  - 1. System status displays and use.
  - 2. Diagnostics.
  - 3. Power fail/restart.
  - 4. Other specified functions.
- E. Data acquisition tests shall include the following:

1. Plant Control System data acquisition via the in-plant PLC fiber optic Ethernet data highway.
2. Alarm/event handling.

### 3.06 INTEGRATED SYSTEM TEST

- A. The integrated system tests may only begin after other testing specified in this section has been completed and test results submitted.
- B. Perform integrated system testing to verify the operation and performance of the complete, integrated control system.
  1. Begin integrated system testing after other field tests have been completed.
  2. Conduct the test for two calendar weeks, 24 hours per day.
  3. Provide full-time, on-site assistance during business days and within four hours after call-in for the test duration.
  4. The Engineer will monitor and participate in the test.
- C. Include the following:
  1. Data communication, both normal and failure modes.
  2. Fully loaded system response times.
  3. Other system operations the Engineer may elect to perform.
- D. Correct deficiencies within 24 hours of notice. If deficiencies remain uncorrected at the end of the test period, the test period will be extended on a day-to-day basis until specified operation can be demonstrated.

END OF SECTION

## SECTION 13800

### POTABLE WATER SUPPLY WELLS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Drilling Well Requirements.
  - 2. Submersible well pump.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with General Conditions covering the items included under this Section.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Submersible Pump:
    - a. Everbilt 1 HP Submersible 3-Wire Motor 20-GPM Deep Well Potable Water Pump OR approved equal.

#### PART 3 - EXECUTION

##### 3.01 GENERAL

- A. The Contractor shall determine the final location of the well in consultation with the client and in compliance with local regulations. The well shall be a 4-inch diameter well equipped with a 1 HP - 20 GPM pump.
- B. Install a 1-inch High-Density Polyethylene (HDPE) water main from the well to the building, including all necessary valves for proper operation and maintenance.
- C. Install a backflow preventer to protect the potable water system from contamination.
- D. Connect the well system to the building's interior potable water system, ensuring seamless integration and functionality.

- E. Provide a 3-year warranty on all parts and labor associated with the well system.

### 3.02 DISINFECTATION AND TESTING

- A. Disinfect the entire water system to ensure it is free from harmful bacteria and contaminants.
- B. Conduct comprehensive water testing to verify the water quality meets all health and safety standards.

### 3.03 ELECTRICAL WORK

- A. Provide electrical connections from the building to the well, ensuring all electrical work complies with local codes and standards.

### 3.04 SITE CLEANUP

- A. Clean up all drilling slurry and debris from the site, leaving the area in a clean and orderly condition.

### 3.05 SYSTEM START-UP AND TESTING

- A. Perform start-up and testing of the entire system to ensure proper operation and performance.

### 3.06 PERMITS AND COMPLIANCE

- A. Obtain all necessary permits from Collier County and the State of Florida to ensure the well system complies with all local and state regulations.

END OF SECTION

## SECTION 13801

### DOMESTIC WATER FILTRATION EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Reverse Osmosis System.
  - 2. Hydro-Pneumatic Tank

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with General Conditions covering the items included under this Section.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. RO System:
    - a. Chem-Aqua CRO-4H Series systems OR approved equal.
  - 2. Hydro-Pneumatic Tank:
    - a. Wessels Company FXA-400 Water Well & Pressure Booster Expansion Tank OR approved equal.

##### 2.02 REVERSE OSMOSIS SYSTEM

- A. RO System shall have an output capacity of approximately 20 gpm and have an odor control and chemical injection.
- B. Proposed RO System will connect to new potable water well and provide potable water to the existing bathroom which includes an existing toilet, existing sink, and a new shower.



## 2.03 HYDRO-PNEUMATIC TANK

- A. Approximately 100 gallon hydro-pneumatic tank to meet 20 gpm RO System requirements.

## PART 3 - EXECUTION

### 3.01 GENERAL

NOT USED

END OF SECTION

## SECTION 15000

### MECHANICAL - GENERAL REQUIREMENTS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. All equipment furnished and installed under this contract shall conform to the general stipulations set forth in this section except as otherwise specified in other sections.
2. Contractor shall coordinate all details of equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alternations in the Work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

###### B. Related Work Described Elsewhere:

1. General Requirements: Division 1
2. Concrete: Division 3
3. Metals: Division 5
4. Equipment: Division 11
5. Special Construction: Division 13
6. Electrical: Division 16

###### C. General Design:

1. Contract Drawings and Specifications: The Contract Drawings and Specifications shall be considered as complementary, one to the other, so that materials and work indicated, called for, or implied by the one and not by the other shall be supplied and installed as though specifically called for by both. The Contract Drawings are to be considered diagrammatic, not necessarily showing in detail or to scale all of the equipment or minor items. In the event of discrepancies between the Contract Drawings and Specifications, or between either of these and any regulations or ordinances governing work of these specifications, the bidder shall notify the Engineer in ample time to permit revisions.

## 1.02 QUALITY ASSURANCE

- A. Materials and Equipment: Unless otherwise specified, all materials and equipment furnished for permanent installation in the work shall conform to applicable standards and specifications and shall be new, unused, and undamaged when installed or otherwise incorporated in the work. No such material or equipment shall be used by the Contractor for any purpose other than that intended or specified, unless such use is specifically authorized in writing by the Owner. No material shall be delivered to the work site prior acceptance of drawings and data by the Engineer.
- B. Equivalent Materials and Equipment:
  - 1. Whenever a material or article is specified or described by using the name of a proprietary product or the name of a particular manufacturer or vendor, the specific item mentioned shall be understood as establishing the type, function, and quality desired. Other manufacturers' products will be accepted provided sufficient information is submitted to allow the Engineer to determine that the products proposed are equivalent to those named. Such items shall be submitted for review in accordance with Section 01340: Shop Drawings, Working Drawings, and Samples.
  - 2. Requests for review of equivalency will not be accepted from anyone except the Contractor and such requests will not be considered until after the contract has been awarded.
- C. Governing Standards: Equipment and appurtenances shall be designed in conformity with ANSI, ASME, ASTM, IEEE, NEMA, OSHA, AGMA, and other generally accepted applicable standards. They shall be of rugged construction and of sufficient strength to withstand all stresses which may occur during fabrication, testing, transportation, installation, and all conditions or operations. All bearings and moving parts shall be adequately protected against wear by bushings or other acceptable means. Provisions shall be made for adequate lubrication with readily accessible means.
- D. Tolerances: Machinery parts shall conform to the dimensions indicated on the drawings within allowable tolerances. Protruding members such as joints, corners, and gear covers shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.
- E. Clearances: Ample clearances shall be provided for inspection and adjustment. All equipment shall fit the allotted space and shall leave reasonable access room for servicing and repairs. Greater space and room required by substituted equipment shall be provided by the Contractor and at his expense.
- F. Testing:

1. When the equipment is specified to be factory tested, the results of the tests shall be submitted to the Engineer and approval of the test results shall be obtained before shipment of the equipment.
2. When an item of equipment, including controls and instrumentation, has been completely erected, the Contractor shall notify the Engineer, who will designate a time to make such tests as required, and operate the item to the satisfaction of the Contractor. All testing shall be done in the presence of the Contractor. "Completely erected" shall mean that the installation is erected, all necessary adjustments have been made, all required utility connections have been made, required lubricants and hydraulic fluid have been added and the unit has been cleaned and painted.

G. Pressure Test:

1. After installation, all piping shall be pressure tested. Piping shall be tested in accordance with Section 15044.
2. All tests shall be made in the presence of and to the satisfaction of the Owner and also, to the satisfaction of any local or state inspector having jurisdiction.
  - a. Provide not less than three days notice to the Owner and the authority having jurisdiction when it is proposed to make the tests.
  - b. Any piping or equipment that has been left unprotected and subject to mechanical or other injury in the opinion of the Owner shall be retested in part or in whole as directed by the Owner.
  - c. The piping systems may be tested in sections as the work progresses by no joint or portion of the system shall be left untested.
3. All elements within the system that may be damaged by the testing operation shall be removed or otherwise protected during the operation.
4. All defects and leaks observed during the tests shall be corrected and made tight in an approved manner and the tests repeated until the system is proven tight.
5. Repair all damage done to existing or adjacent work or materials due to or on account of the tests.
6. Provide test pumps, gauges, or other instruments and equipment required for the performance of all tests. Provide all temporary bracing, test plugs, additional restraint, and thrust blocking which may be required for test pressures above normal working pressures.

7. All tests shall be maintained for as long a time as required to detect all defects and leaks but not less than the duration specified for each type of pipe or piping system in this Division.

H. Failure of Test:

1. Defects: Any defects in the equipment, or deviations from the guarantees or requirements of the Specifications, shall be promptly corrected by the Contractor by replacements or otherwise. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to correct any defects or deviations, or if the replaced equipment when tested shall fail again to meet the guarantees or specified requirements, the Owner, notwithstanding his having made partial payment for work and materials which have entered into the manufacturer for such equipment, may reject that equipment and order the Contractor to remove it from the premises at the Contractor's expense.
2. Rejection of Equipment: In case the Owner rejects a particular item of equipment, then the Contractor hereby agrees to repay to the Owner all sums of money paid to him to deliver to the Contractor a bill of sale of all his rights, title, and interest in and to the rejected equipment provided, however that the equipment shall not be removed from the premises until the Owner obtains from other sources other equipment to take the place of that rejected. The bill of sale shall not abrogate the Owner's right to recover damages for delays, losses or other conditions arising out of the basic Contract. The Owner hereby agrees to obtain the alternate equipment within a reasonable time and the Contractor agrees that the Owner may use the original equipment furnished by him without rental or other charge until the other equipment is obtained.

- I. Responsibility During Tests: The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

J. Acceptance of Materials:

1. Only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the Contractor shall be subject to the inspection and acceptance of the Owner. No material shall be delivered to the work without prior submittal approval of the Engineer.
2. The Contractor shall submit to the Project Manager and Professional Engineer data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the specifications.

3. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the Contractor shall submit samples of materials for such special test as may be necessary to demonstrate that they conform to the specification. Such sample shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for tests.
4. The Contractor shall submit data and samples sufficiently early to permit consideration and acceptance before materials are necessary for incorporation in the work.

K. Safety Requirements:

1. In addition to the components shown and specified, all machinery and equipment shall be safeguarded in accordance with the safety features required by the current codes and regulations of ANSI, OSHA, and local industrial codes.
2. The Contractor shall provide for each V-belt drive or rotating shaft a protective guard which shall be securely bolted to the floor or apparatus. The guard shall completely enclose drives and pulleys and be constructed to comply with all safety requirements.
3. For double inlet fans, the belt guard shall be arranged so as not to restrict the air flow into the fan inlet. Guards shall not interfere with lubrication of equipment.
4. Any overhead mechanical equipment, systems, or components shall have a minimum clearance of 7 feet-6 inches above the finished floor.

1.03 SUBMITTALS (SEE SECTION 01340: SHOP DRAWINGS, WORKING DRAWINGS AND SAMPLES)

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Packaging: All equipment shall be suitably packaged to facilitate handling and protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.
- B. Protection: All machined surfaces and shafting shall be cleaned and protected from corrosion by the proper type and amount of coating necessary to assure protection during shipment and prior to installation. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage as specified in Sections 09900 and 09905. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

- C. Lubrication: Grease and lubricating oil shall be applied to all bearings and similar items as necessary to prevent damage during shipment and storage.
- D. Marking: Each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.
- E. Fabricated sub-assemblies, if any, shall be shipped in convenient sections as permitted by carrier regulations and shall be properly match-marked for ease of field erection.
- F. Responsibility:
  - 1. The Contractor shall be responsible for all material, equipment, and supplies sold and delivered to the site under this Contract until final inspection of the work and acceptance thereof by the Owner. In the event any such material, equipment, and supplies are lost, stolen, damaged, or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.
  - 2. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.
- G. Delivery: The Contractor shall arrange deliveries of products in accordance with construction schedules and coordinate to avoid conflict with work and condition at the site.
  - 1. The Contractor shall deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
  - 2. Immediately on delivery, the Contractor shall inspect shipments to assure compliance with requirements of Contract Documents and accepted submittals, and that products are properly protected and undamaged.
  - 3. Under no circumstances shall the Contractor deliver equipment to the site more than one month prior to installation without written authorization from the Owner. Operation and maintenance data shall be submitted to the Engineer for review prior to shipment of equipment as described in Section 01730: Operating and Maintenance Data.

H. Storage and Protection of Products:

1. The Contractor shall furnish a covered, weather-protected storage structure providing a clean, dry noncorrosive environment for all mechanical equipment, valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this project. Storage of equipment shall be in strict accordance with the "Instructions for Storage" of each equipment supplier and manufacturer including connection of space heaters, and placing of storage lubricants in equipment. Corroded, damaged, or deteriorated equipment and parts shall be replaced before acceptance of the project. Equipment and materials not properly stored will not be included in a payment estimate.
  - a. The Contractor shall store products subject to damage by the elements in weathertight enclosures.
  - b. The Contractor shall maintain temperature and humidity within the ranges required by manufacturer's instructions.
  - c. The Contractor shall store fabricated products above the ground, on blocking or skids, to prevent soiling or staining. The Contractor shall cover products which are subject to deterioration with impervious sheet coverings and provide adequate ventilation to avoid condensation.
  - d. The Contractor shall store loose granular materials in a well drained area on solid surfaces to prevent mixing with foreign matter.
2. All materials and equipment to be incorporated in the work shall be handled and stored by the Contractor before, during, and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft, or damage of any kind whatsoever to the material or equipment.
3. Cement, sand, lime shall be stored under a roof and off the ground, and shall be kept completely dry at all times. All structural and miscellaneous steel and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt, or grease, and in a position to prevent accumulations of standing water, staining, chipping, or cracking. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking and peeling to a minimum.
4. All materials which, in the opinion of the Owner, have become damaged and are unfit for the use intended or specified, shall be promptly removed from the site of the work, and the Contractor shall receive no compensation for the damaged material or its removal.
5. The Contractor shall arrange storage in a manner to provide easy access for inspection. The Contractor shall make periodic inspections of stored products to



assure products are maintained under specified conditions, and free from damage or deterioration.

6. Protection After Installation: The Contractor shall provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. The Contractor shall remove covering when no longer needed.

- I. Extended Storage Requirements For Equipment: Because of the long period allowed for construction, special attention shall be given to extended storage and handling of equipment onsite. As a minimum, the procedure specified herein shall be followed:

1. If equipment will be stored onsite for more than one month prior to incorporation into the Work, the Contractor shall submit a written request to the Owner outlining any special provision to be made to protect and maintain the equipment while it is being stored. All such provisions shall be acceptable to the Owner. No equipment shall be stored onsite for more than one month without prior written authorization from the Owner.
2. All equipment having moving parts including gears, electric motors, and/or instruments shall be stored in a temperature and humidity controlled building accepted by the Owner, until such time as the equipment is to be installed.
3. All equipment shall be stored fully lubricated with oil and grease unless otherwise instructed by the manufacturer.
4. Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed by him with the Owner. These instructions shall be carefully followed and a written record of this review kept by the Contractor.
5. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, and operate loaded when possible, weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
6. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. Mechanical equipment to be used in the work, if stored for longer than ninety days, shall have the bearings cleaned, flushed, and lubricated prior to testing and startup, at no extra cost to the Owner.
7. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been

shipped, installed, tested, and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective, and it shall be removed and replaced at the Contractor's expense.

8. A maintenance log shall be maintained by the Contractor outlining the schedule of maintenance required for each piece of equipment as well as the date on which the maintenance was actually performed and the initials of the individual performing the work. Submit a copy of the maintenance log monthly with the progress pay application.

#### 1.05 WARRANTY AND GUARANTEES

- A. The manufacturer's written warranty shall be submitted for all major pieces of equipment, as specified in Section 01740: Warranties and Bonds. The manufacturer's warranty period shall be concurrent with the Contractor's correction period for 2 years after the time of completion and acceptance.

### PART 2 - PRODUCTS

#### 2.01 GENERAL

- A. All materials that come into contact with the water being treated or the finished water shall be on either the EPA or NSF lists of products approved for use in contact with potable water. Manufacturers shall submit an affidavit with the shop drawings indicating approval by the EPA or NSF for the materials used in products that come into contact with the water, in accordance with Rule 62-555.320(3) Florida Administrative Code.

#### 2.02 MATERIALS AND EQUIPMENT

- A. Fabrication and Manufacture:
  1. Workmanship and Materials:
    - a. Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage or other failure. Materials shall be suitable for service conditions.
    - b. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and gages so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.

- c. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch thick.

2. Lubrication:

- a. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrications systems shall not require attention during startup or shutdown and shall not waste lubricants.
- b. Lubricants of the type recommended by the equipment manufacturer shall be furnished by the Contractor in sufficient quantity to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by Owner. Unless otherwise specified or permitted, the use of synthetic lubricants will not be acceptable.
- c. Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

3. Electric Motors: Unless otherwise specified, motors furnished with equipment shall meet the following requirements:

- a. Designed and applied in accordance with NEMA, ANSI, IEEE, AFBMA, and NEC for the duty service imposed by the driven equipment, such as frequent starting, intermittent overload, high inertia, mounting configuration, or service environment.
- b. Rated for continuous duty at 65 C ambient, unless the application is well recognized for intermittent duty service as a standard industry practice.
- c. Insulated with Class B, Class F, or Class H insulation and designed for a service factor of 1.00, 1.15, or greater.
- d. Three phase motors used in conjunction with variable speed drives shall be inverter duty MG-1 Part 31, 1000 peak voltage, 10,000 dv/dc.
- e. When operating at service factor load, maximum observable temperature rise of insulation and motor parts, as determined by

resistance or thermometer methods, shall not exceed the NEMA allowable limits for the type of motor, the type of enclosure, and the particular application with regard to continuous or intermittent duty.

- f. To ensure long motor life, nameplate horsepower, regardless of service factor, shall be at least 115 percent of the maximum load imposed by the driven equipment.
- g. Designed for full voltage starting.
- h. Designed to operate from an electrical system that may have a maximum of 5 percent voltage distortion per IEEE Standard 519.
- i. Derated, if required, for the altitude at which the equipment is installed.
- j. Clamp-type grounding terminal shall be inside motor conduit box.
- k. External conduit boxes shall be oversized at least one size larger than NEMA standard.
- l. Totally enclosed motors shall have a continuous moisture drain which also excludes insects.
- m. Bearings shall be either oil or grease lubricated.
- n. Manufacturer's standard motor may be supplied on integrally constructed, packaged assemblies such as appliances, tools, unit heaters, and similar equipment specified by model number, in which case a redesign of the unit would be required to furnish motors of other than the manufacturer's standard design. However, in all cases, totally enclosed motors are preferred and shall be totally enclosed motors are preferred and shall be furnished if offered by the manufacturer as a standard option.
- o. Totally enclosed motors shall be furnished on:
  - 1) Outdoor equipment.
  - 2) Equipment for installation below grade.
  - 3) Chemical feeding and chemical handling equipment.
  - 4) Equipment operating in wet or dust-laden locations.
- p. Totally enclosed fan cooled motors may be furnished in lieu of open drip proof motors on equipment in indoor, above-grade, clean, and dry locations.

- q. Explosion proof or submersible motors shall be furnished as required by applicable codes, as specified in other sections, or at the supplier's option.
- r. Motors shall be rated and constructed as follows:
  - 1) Below 1/2 hp:  
  
115 volt, 60 Hz, single phase.  
  
Built-in manual-reset thermal protector, or integrally mounted stainless steel enclosed manual motor starter.
  - 2) 1/2 hp and above:  
  
460 volt, 60 Hz, 3 phase.  
  
Where specified or required by the drawings, motors used on 208 volt systems shall be 200 volt, 60 Hz, 3 phase.
- s. Premium efficient motors shall be provided for the motor driven equipment, except where explosionproof motors are required or where used in ventilation equipment above the roof and for submersible use. Certification shall be supplied for each size, speed and type of motor indicating the guaranteed minimum efficiency at full load and that the efficiency tests were done in accordance with IEEE Standard 112, Test Method B, using accuracy improvement by segregated loss determination including stray load loss improvement as specified in NEMA Standard MG1-12.53a.
- t. Power factor correction capacitors shall be provided for each constant speed, across-the-line start motor sized 10 hp and larger. Capacitors shall be weatherproof type with a corrosion-resistant finish, complete with mounting hardware, 480 volts, and shall be connected to the motor terminals except as otherwise indicated on the drawings. Capacitors shall be sized to improve power factor at motor full load rating to approximately 95 percent, but not greater than the applicable motor manufacturer's recommendations, for the particular motors to which the capacitors are applied. Motor overloads shall be sized, taking into account the reduced motor current when connected with capacitors.
- u. Six certified copies of the shop test results shall be furnished for each motor larger than 50 horsepower. Balance and vibration tests shall be included to meet NEMA Standards MG 1-12.05 and MG 1-12.06. The Contractor shall submit shop drawings and data sheets covering all

items listed herein including frame dimensions, mounting, coupling details and full load power factor, efficiency of full load and maximum KVAR factor for the Engineer's acceptance. The Contractor shall furnish operation and maintenance manuals as specified in Section 01730: Operating and Maintenance Data.

4. Drive Units: The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Drive units shall be designed for 24 hour continuous service.

- a. Gear Reducers:

- 1) Each gear reducer shall be a totally enclosed unit with oil or grease lubricated antifriction, rolling element bearings throughout.
- 2) Helical, spiral bevel, combination bevel-helical, and worm gear reducers shall have a service factor of at least 1.50 based on the nameplate horsepower of the drive motor. Shaft-mounted and flange-mounted gear reducers shall be rated AGMA Class 11. Helical gear reducers shall have a gear strength rating to catalog rating of 1.5. Each gear reducer shall bear an AGMA nameplate.
- 3) The thermal horsepower rating of each unit shall equal or exceed the nameplate horsepower of the drive motor. During continuous operation, the maximum sump oil temperature shall not rise more than 100 F above the ambient air temperature in the vicinity of the unit and shall not exceed 200 F.
- 4) Each grease lubricated bearing shall be installed in a bearing housing designed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun. Each bearing housing shall be designed to evenly distribute new grease, to properly dispose of old grease, and to prevent overgreasing of the bearing. The use of permanently sealed, grease lubricated bearings will not be acceptable. An internal or external oil pump and appurtenances shall be provided if required to properly lubricate oil lubricated bearings. A dipstick or sight glass arranged to permit visual inspection of lubricant level shall be provided on each unit.
- 5) Gear reducers which require the removal of parts or periodic disassembly of the unit for cleaning and manual regreasing of bearings will not be acceptable.
- 6) Certification shall be furnished by the gear reducer manufacturer indicating that the intended application of each

unit has been reviewed in detail by the manufacturer and that the unit provided is fully compatible with the conditions of installation and service.

- b. Variable Speed Drives: Each variable speed drive shall have a service factor of at least 1.75 at maximum speed based on the nameplate horsepower of the drive motor. A spare belt shall be provided with each variable speed drive unit employing a belt for speed change. Unless specifically permitted by the detailed equipment specifications, bracket type mounting will not be acceptable for variable speed drives.
  - c. V-Belt Drives: Each V-belt drive shall include a sliding base or other suitable tension adjustment. V-belt drives shall have a service factor of at least 1.6 maximum speed based on the nameplate horsepower of the drive motor.
5. Safety Guards: All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gage or heavier galvanized or aluminum-clad sheet steel or 1/2 inch mesh galvanized expanded metal. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.
6. Equipment Foundation Supports:
- a. All foundations, platforms and hangers required for the proper installation of equipment shall be furnished and installed by the Contractor.
  - b. Unless otherwise indicated or specified, all equipment shall be installed on reinforced concrete bases at least 6 inches high and shall conform to Section 03300. Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components and adequate grout holes. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in Section 03600: Grout. All open equipment bases shall be filled with nonshrinking grout sloped to drain to the perimeter of the base.
  - c. The Contractor shall furnish, install and protect all necessary guides, bearing plates, anchor and attachment bolts, and all other

appurtenances required for the installation of equipment. These shall be of ample size and strength for the purpose intended.

- d. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Anchor bolts shall comply with Section 05500: Miscellaneous Metals and, unless otherwise specified, shall have a minimum diameter of 3/4 inch. Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.
  - e. Structural steel supports and miscellaneous steel required for supporting and/or hanging equipment and piping furnished under this Division shall be provided and installed by Contractor.
  - f. All foundations, anchor pads, piers, thrust blocks, inertia blocks and structural steel supports shall be built to template and reinforced as required for loads imposed on them.
  - g. The Contractor shall assume all responsibility for sizes, locations and design of all foundations, anchor pads, pier, thrust blocks, inertia blocks, curbs and structural steel supports.
7. Equipment weighing more than 100 pounds shall be furnished with lifting eyes.
8. Shop Painting:
- a. All steel and iron surfaces shall be protected by suitable paint or coatings applied in the shop. Surfaces which will be inaccessible after assembly shall be protected for the life of the equipment. Exposed surfaces shall be finished smooth, thoroughly cleaned, and filled as necessary to provide a smooth uniform base for painting. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with a high-grade oil resistant enamel suitable for coating in the field with an alkyd enamel. Coatings shall be suitable for the environment where the equipment is installed.
  - b. Surfaces to be painted after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of the specified primer. Unless otherwise specified, the shop primer for steel and iron surfaces shall be Cook "391-N-167 Barrier Coat", Koppers "No. 10 Inhibitive Primer", or equal.



- c. Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound, Houghton "Rust Veto 344", Rust-Oleum "R-9", or equal.
- 9. Nameplates: Contractor shall provide equipment identification nameplates for each item of equipment. Nameplates shall be 1/8-inch Type 304 stainless steel and shall be permanently fastened. Plates shall be fastened using round head metallic drive screws, or where metallic drive screws are impractical, with stainless steel pop rivets. Metallic drive screws shall be brass or stainless steel, Type V and No. 8 by 3/8-inch long. Names and/or equipment designations shall be engraved on the plates and the engraving painted with a primer and black paint system compatible with stainless steel. Contractor shall submit a list of proposed names and designations for review prior to fabrication of nameplates. At a minimum, each nameplate shall include equipment manufacturers name, year of manufacture, serial number and principal rating data.
- 10. Pipe Identification:
  - a. All pipe (except underground) shall have code letters and flow arrows painted as per specification Section 09905. The contractor shall ensure that the pipes are properly marked.
- 11. Valve Identification: On all valves, except shut-off valves located at a fixture or piece of equipment, the Contractor shall provide a coded and numbered tag attached with brass chain and/or brass "S" hooks.
  - a. Tag Types:
    - 1) Tags for valves on pipe and tube lines conducting hot medium (steam, condensate, hot water, etc.) shall be brass or anodized aluminum.
    - 2) Tags for all other valves shall be Type 304 stainless steel.
    - 3) Square tags shall be used to indicate normally closed valves and round tags shall indicate normally open valves.
  - b. Coding: In addition to the color coding, each tag shall be stamped or engraved with wording or abbreviations to indicate the line service. All color and letter coding shall be approved by the Engineer.
  - c. Valve Schedule: The Contractor shall provide a typewritten list of all tagged valves giving tag shape, letter code and number, the valve size, type, use and general location within building.

12. Noise Attenuation and Control:

- a. Unless otherwise specified, the maximum permissible noise level for a complete installed piece of equipment located within or outside a structure shall not exceed 85 dB at 3 feet. A complete piece of equipment includes the driver and driven equipment, plus any intermediate couplings, gears, and auxiliaries. All equipment provided herein that is specified to be factory and field tested shall be tested as specified herein for noise generation at the equipment manufacturer's expense.
- b. Maximum permissible noise (sound pressure) levels shall be in decibels as read on the "A" weighting scale of a standard sound level meter (dB); all measurements shall be made in relation to a reference pressure of 0.0002 microbar. Measurements of emitted noise levels shall be made on a sound level meter meeting at least the Type 2 requirements set forth in ANSI S1.4, Specification for Sound Level Meters. The sound level meter shall be set on the "A" scale and to slow response. Unless otherwise specified for a particular piece of equipment, the point of measurement of sound level shall be made at the specified distance from any major surface along the entire perimeter and at midheight of the piece of equipment, or at the specified distance from an outer major surface encompassing the sound source including inlets or outlets.

13. Fire Hazard Rating:

- a. All piping, duct work, and equipment insulation, fastener, and jacketing materials shall have a fire hazard rating not to exceed 25 for flame spread, 50 for fuel contributed, and 50 for smoke developed. Rating shall be determined by ASTM Designation E84, "Surface Burning Characteristics of Building Materials". Corresponding ratings determined by Underwriters' Laboratories, Inc., UL-723, "Test Method for Fire Hazard Classification of Building Materials", will also be acceptable.
- b. Flameproofing treatments will not be acceptable.

14. Heating, Ventilation and Domestic Plumbing Equipment:

- a. Interchangeability: In all design and purchasing, interchangeability of items of equipment, subassemblies, parts, motors, starters, relays, and other items is essential. All similar items shall be of the same manufacturer, type, model, and dimensions.

2.03 ACCESSORIES

- A. Special Tools and Accessories: Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

#### 2.04 SPARE PARTS

- A. Spare parts for certain equipment provided under Divisions 11, 13, 14, 15, and 16 have been specified in the pertinent sections of the specifications. The Contractor shall collect and store all spare parts in an area to be designated by the Engineer. In addition, the Contractor shall furnish to the Engineer an inventory listing of all spare part, the equipment they are associated with, and the name and address of the supplier.
- B. Maintenance Materials:
  - 1. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied.
  - 2.. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three weeks of operation.

#### 2.05 QUALITY CONTROL

- A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for project.

### PART 3 - EXECUTION

#### 3.01 PREPARATION (Not Applicable)

#### 3.02 INSTALLATION

- A. Installation: Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary for proper results. When so specified, or when employees of Contractor or his subcontractors are not qualified, such personnel shall be field representatives of the manufacturer of the equipment or materials being installed.
  - 1. The Contractor shall have on site sufficient proper construction equipment and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character. To minimize field erection problems, mechanical units shall be factory assembled when practical.

2. Equipment shall be erected in a neat and workmanlike manner on the foundations and supports at the locations and elevations shown on the Drawings, unless otherwise directed by the Engineer during installation.
  3. All equipment shall be installed in such a manner as to provide access for routine maintenance including lubrication.
  4. For equipment such as pumping units, which require field alignment and connections, the Contractor shall provide the services of the equipment manufacturer's qualified mechanic, millwright, machinist, or authorized representative, to align the pump and motor prior to making piping connections or anchoring the pump base.
  5. Equipment of a portable nature which require no installation shall be delivered to a location designated by the Owner.
- B. Tolerances: Precision gauges and levels shall be used in setting all equipment. All piping and equipment shall be perfectly aligned, horizontally and vertically. Tolerances for piping and equipment installation shall be 1/2 inch to 30 ft horizontal and vertically. All valves and operators shall be installed in the position shown on the Contract Drawings or as directed by the Engineer, if not shown.
- C. Alignment and Level: The equipment shall be brought to proper level by shims (1/4 inch maximum). After the machine has been leveled and aligned, the nuts on the anchor bolts shall be tightened to bind the machine firmly into place against the wedges or shims. Grouting shall be as specified in Section 03600: Grout.
- D. Grouting: The grout shall be tamped into position with a board, steel bar, or other tool. Tamping should not be so hard as to raise or otherwise displace the plate.
- E. Contact of Dissimilar Metals: Where the contact of dissimilar metal may cause electrolysis and where aluminum will contact concrete, mortar, or plaster, the contact surface of the metals shall be separated using not less than one coat of zinc chromate primer and one heavy coat of aluminum pigmented asphalt paint on each surface.
- F. Cutting and Patching: All cutting and patching necessary for the work shall be performed by the Contractor.
- G. Operation: All equipment installed under this Contract, including that furnished by Owner or others under separate contract, shall be placed into successful operation according to the written instructions of the manufacturer or the instructions of the manufacturer's field representative. All required adjustments, tests, operation checks, and other startup activity shall be provided.
- H. Large (greater than 10 horsepower) and critical equipment motors shall be installed above grade and above the 100 year flood plain.

### 3.03 INSPECTION AND TESTING

- A. Where the specifications require observation of performance tests by the Owner such tests shall comply with the quality assurance paragraph in this section.

### 3.04 START-UP AND INSTRUCTION

- A. Services Furnished Under This Contract:
  - 1. An experienced, competent, and authorized representative of the manufacturer of each item of equipment shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's representative shall be present when the equipment is placed in operation. The manufacturer's representative shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Owner.
  - 2. Each manufacturer's representative shall furnish to Owner a letter of certification stating that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.
  - 3. All costs for field services shall be included in the contract amount.

END OF SECTION

## SECTION 15041

### DISINFECTION OF POTABLE WATER PIPING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. This section specifies materials and procedures for disinfection of potable water mains. Do not use the tablet method to disinfect pipelines. Disinfect piping in accordance with AWWA Standard C651, except as modified below. Disinfection of piping shall meet the requirements of the FDEP regulations given in 62-555.340 F.A.C. Disinfection of pipelines used for reclaimed water is not required.

##### 1.02 SCOPE OF WORK

- A. The proper disinfection and bacteriological clearance of process facilities (piping, tanks, vessels, pumps, and other equipment) prior to start-up commencement is essential to preventing biological contamination that may cause or contribute to membrane fouling and other operational complications, therefore in addition to regulatory requirements for disinfection, the Contractor shall provide flushing and disinfection of all proposed process facilities in the same manner as is required for potable water system components. This requirement shall be provided regardless of the proposed service, with the exception of sanitary sewer lines, building drain lines and wastewater force mains. Chlorinated water shall not be passed through the existing treatment skid.

##### 1.03 JOB CONDITIONS

- A. Discharge of chlorinated water into watercourses or surface waters is regulated by the National Pollutant Discharge Elimination System (NPDES). Apply to environmental regulation authority, Florida Department of Environmental Protection and obtain permit, for permission to discharge. Disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility.
- B. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with Owner and regulatory authorities.
- C. The Contractor shall only use potable water for flushing, disinfection, and post flushing.
- D. Submit requests for use of water from waterlines of Owner 48 hours in advance.

##### 1.04 SUBMITTALS

- A. Copies of all laboratory test results.

- B. Copies of all FDEP correspondence.
- C. Sampling location drawing.

## PART 2 - MATERIALS

### 2.01 LIQUID CHLORINE

Inject with a solution feed chlorinator and a water booster pump. Use an experienced operator and follow the instructions of the chlorinator manufacturer.

### 2.02 CALCIUM HYPOCHLORITE (DRY)

Dissolve in water to a known concentration in a drum and pump into the pipeline at a metered rate.

### 2.03 SODIUM HYPOCHLORITE (SOLUTION)

Further dilute in water to desired concentration and pump into the pipeline at a metered rate.

### 2.04 CHLORINE RESIDUAL TEST KIT

For measuring chlorine concentration, supply chlorine residual testing instruments and equipment conforming to the requirements of FDEP Standard Operating Procedures for Field Activities, DEP-SOP-001/01, using DPD Colorimetric Method, Titrimetric Method, or Ion-Selective Electrode. Maintain field test kits in good working order available for immediate test of residuals at point of sampling.

## PART 3 - EXECUTION

### 3.01 PIPELINE FLUSHING

All pipelines shall be flushed clean of deleterious material prior to disinfection.

### 3.02 CONTINUOUS FEED METHOD FOR PIPELINES

Introduce potable water into the pipeline at a constant measured rate. Feed the chlorine solution into the same water at a measured rate. Proportion the two rates so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 50 mg/L. Check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added.

### 3.03 DISINFECTION OF VALVES AND APPURTENANCES

During the period that the chlorine solution is in the section of pipeline, open and close valves to obtain a chlorine residual at hydrants and other pipeline appurtenances. Valves connected to the existing water system shall be manipulated by the County.

### 3.04 DISINFECTION OF CONNECTIONS TO EXISTING PIPELINES

Disinfect per AWWA C651, Section 9. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 1% sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor.

### 3.05 CONFIRMATION OF RESIDUAL

Total residual chlorine measurements as required herein are to be performed in the field by the Contractor at the time of sample collection in accordance with FDEP-SOP-001/01. After the chlorine solution applied by the continuous feed method has been retained in the pipeline for 24 hours, confirm that a chlorine residual of 25 mg/L minimum exists along the pipeline by sampling at air valves and other points of access.

### 3.06 POST CHLORINATION FLUSHING

After confirming the chlorine residual, flush the excess chlorine solution from the pipeline until the total chlorine residual in the water leaving the pipe is within 0.5 mg/l of the replacement water and no more than 4.0 mg/L.

### 3.07 CHLORINE RESIDUAL AND BACTERIOLOGIC TESTS

1. After reducing total chlorine residual to no more than 4.0 mg/L, the Contractor will collect one sample per day at each sample point on two consecutive days, and the samples shall be analyzed for total chlorine residual and for the presence of total coliform bacteria. Total chlorine residual is to be measured in the field by the Contractor using methods approved by FDEP-SOP-001/01. The total coliform analysis is to be performed by a laboratory of the Department of Health (DOH) or a laboratory certified by the DOH to perform bacteriological analyses of drinking water.
2. Deliver to the certified laboratory within 22 hours of obtaining the samples, and obtain a bacteriologic quality test to demonstrate the absence of coliform organisms in each separate section of the pipeline. For lines longer than 2 miles, obtain one additional test each mile. Test between all valves in each direction.

### 3.08 REPETITION OF PROCEDURE

If the initial chlorination fails to produce required residuals or bacteriologic tests reveal the presence of total coliforms, repeat the chlorination and retesting until satisfactory results are obtained. If any bacteriological sample contains more than 4.0 mg/L, the test shall be considered invalid.

### 3.09 TEST FACILITY REMOVAL

After satisfactory disinfection, replace air valves, restore the pipe coating, and complete the pipeline where temporary disinfection or test facilities were installed. Any test stations



removed prior to receipt of acceptable lab results will be required to be replaced at the Contractor's expense should retesting be required.

#### 3.10. PIPING TO BE DISINFECTED

Disinfect all purification process piping per AWWA.

#### 3.11. DISINFECTION OF STRUCTURES

- A. Disinfect per AWWA C652, Method 2.
- B. Remove any chlorine solution which accumulates in the bottom of the structure each day.

END OF SECTION

## SECTION 15044

### PRESSURE TESTING OF PIPING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Scope of Work: This section specifies the leakage testing requirements for plant piping.
- B. Related Work Described Elsewhere (not applicable)
- C. General Design (not applicable)

##### 1.02 QUALITY ASSURANCE

- A. Test Pressures: Test pressures for the various services and types of piping shall be as shown in the Piping Schedule in the Drawings, and at a minimum shall be 1.5 times the working pressure.

##### 1.03 SUBMITTALS

- A. Materials and Shop Drawings (Not Applicable)
- B. Additional Information:
  - 1. Testing Plan: Submit prior to testing and include at least the information that follows:
    - a. Testing dates.
    - b. Piping systems and section(s) to be tested.
    - c. Test type.
    - d. Method of isolation.
    - e. Calculation of maximum allowable leakage for piping section(s) to be tested.
  - 2. Certifications of Calibration: Testing equipment.
  - 3. Certified Test Report.
  - 4. Testing Records:

- a. Provide a record of each piping installation during the testing. These records shall include:
  - 1) Date of test.
  - 2) Identification of pipeline tested or retested.
  - 3) Identification of pipeline material.
  - 4) Identification of pipe specification.
  - 5) Test fluid.
  - 6) Test pressure.
  - 7) Remarks: Leaks identified (type and location), types of repairs, or corrections made.
  - 8) Certification by Contractor that the leakage rate measured conformed to the specifications.
  - 9) Signature of Owner's representative witnessing pipe test.
- b. Submit five (5) copies of the test records to the Engineer's representative upon completion of the testing.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. Testing fluid shall be clean water for all piping except air service and shall be of such quality to prevent corrosion of materials in piping system for all hydrostatic tests. Air piping shall be tested using compressed air.

### 2.02 MATERIALS AND EQUIPMENT

- A. Provide pressure gauges, necessary bracing and restraint, test plugs, pipes, bulkheads, pumps, and meters to perform the hydrostatic and pneumatic testing.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Pipes shall be in place and anchored before commencing pressure testing.
- B. Conduct hydrostatic and pneumatic tests on exposed and aboveground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.
- C. Before conducting hydrostatic tests, flush pipes with water to remove dirt and debris. For pneumatic tests, blow air through the pipes.
- D. Test new pipelines which are to be connected to existing pipelines by isolating the new line from the existing line by means of pipe caps, special flanges, or blind flanges. After the new line has been successfully tested, remove caps or flanges and connect to the existing piping.
- E. Conduct hydrostatic tests on buried pipe after the trench has been completely backfilled. The pipe may be partially backfilled and the joints left exposed for inspection for an initial leakage test. Perform the final test, however, after completely backfilling and compacting the trench.
- F. Chlorine Piping: Test, dry, and clean in accordance with requirements of Chlorine Institute Pamphlet 6.
- G. New Piping Connected to Existing Piping: Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to ENGINEER.
- H. Items that do not require testing include: Piping between wet wells and wetwell isolation valves, equipment seal drains, tank overflows to atmospheric vented drains, and tank atmospheric vents.
- I. Gravity Piping:
  - 1. Perform testing after service connections, manholes, and backfilling have been completed between stations to be tested.
  - 2. Determine groundwater level at time of testing by exploratory holes or other method acceptable to ENGINEER.
- J. Pressure Test:
  - 1. All tests shall be made in the presence of and to the satisfaction of the Owner or Engineer and also, to the satisfaction of any local or state inspector having jurisdiction.

- a. Provide not less than three (3) days notice to the Owner, Engineer, and the authority having jurisdiction when it is proposed to make the tests.
  - b. Any piping or equipment that has been left unprotected and subject to mechanical or other injury in the opinion of the Engineer shall be retested in part or in whole as directed by the Engineer.
  - c. The piping systems may be tested in sections as the work progresses, but no joint or portion of the system shall be left untested.
2. All elements within the system that may be damaged by the testing operation shall be removed or otherwise protected during the operation.
  3. Repair all damage done to existing or adjacent work or materials due to or on account of the tests.

### 3.02 INSTALLATION (Not Applicable)

### 3.03 INSPECTION AND TESTING

- A. Hydrostatic Testing of Aboveground or Exposed Piping: The maximum filling velocity shall be 0.25 feet per second, applied over full area of pipe. Open vents at high points of the piping system to purge air while the pipe is being filled. Subject the piping system to the test pressure indicated. Maintain the test pressure for a minimum of four (4) hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show no leakage or weeping. Correct leaks and retest until no leakage is obtained.
- B. Hydrostatic Testing of Buried Piping:
  1. Test after backfilling has been completed. Expel air from piping system during filling.
  2. Where any section of the piping contains concrete thrust blocks or encasement, do not make the pressure test until at least 10 days after the concrete has been poured. When testing mortar-lined piping, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.
  3. Apply and maintain the test pressure by means of a hydraulic force pump. Maintain the test pressure for a minimum duration of four (4) hours. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure during the four hours. This amount of water is the loss due to leakage in the piping system. The allowable leakage rate is defined by the formula.

$$L = \frac{SD(P)^{1/2}}{133,200}$$

in which:

L	=	allowable leakage (gallons/hour) during the test period.
S	=	length of pipe, in feet
D	=	diameter of the pipe (inches)
P	=	specified test pressure (psig)

4. Repair and retest any pipes showing leakage rates greater than that allowed.

C. Pneumatic Test for Pressure Piping:

1. Do not perform on PVC or CPVC pipe.
2. Fluid: Oil-free, dry air.
3. Procedure:
  - a. Apply preliminary pneumatic test pressure of 25 psig maximum to piping system prior to final leak testing, to locate visible leaks. Apply soap bubble mixture to joints and connections, examine for leakage.
  - b. Correct visible leaks and repeat preliminary test until visible leaks are corrected.
  - c. Gradually increase pressure in system to half of specified test pressure. Thereafter, increase pressure in steps of approximately one-tenth of specified test pressure until required test pressure is reached.
  - d. Maintain pneumatic test pressure continuously for minimum of 10 minutes and for such additional time as necessary to conduct soap bubble examination for leakage.
  - e. Correct visible leakage and retest as specified.
4. Allowable Leakage: Piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leakage.
5. After testing and final cleaning, purge with nitrogen those lines that will carry flammable gases to assure no explosive mixtures will be present in system during filling process.

D. Hydrostatic Test for Gravity Piping:

1. Testing Equipment Accuracy: Plus or minus 1/2 gallon of water leakage under specified conditions.

2. Maximum Allowable Leakage: 0.16 gallon per hour per inch diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.
3. Gravity Sanitary and Roof Drain Piping: Test with 15 feet of water to include highest horizontal vent in filled piping. Where vertical drain and vent systems exceed 15 feet in height, test systems in 15-foot vertical sections as piping is installed.
4. Exfiltration Test:
  - a. Hydrostatic Head:
    - 1) At least 6 feet above maximum estimated groundwater level in section being tested.
    - 2) No less than 6 feet above inside top of highest section of pipe in test section, including service connections.
5. Infiltration Test:
  - a. Groundwater Level: At least 6 feet above inside top of highest section of pipe in test section, including service connections.
6. Piping with groundwater infiltration rate greater than allowable leakage rate for exfiltration will be considered defective even if pipe previously passed a pressure test.
7. Defective Piping Sections: Replace or test and seal individual joints, and retest as specified.

E. Test Pressure:

1. All pipe shall be tested at pressures shown in the Piping Schedule in the Drawings, and at a minimum shall be 1.5 times the normal working pressure of the pipe.

3.04 START-UP AND INSTRUCTION (NOT APPLICABLE)

END OF SECTION

## SECTION 15062

### DUCTILE IRON PIPE AND FITTINGS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Scope of Work: Provide and install ductile iron pipe of the sizes and in the locations shown on the Drawings conforming to the Pipe and Fitting Material Schedule shown on the Drawings and as specified herein.
- B. Related Work Described Elsewhere:
  - 1. Earthwork: Section 02200.
  - 2. Material and Equipment: Section 01600.
  - 3. Piping, Valve, and Equipment Identification System: Section 09905.
  - 4. Pressure Testing of Piping: Section 15044.
- C. General Design (Not Applicable)

##### 1.02 QUALITY ASSURANCE

- A. Standards (as applicable):
  - 1. Cement mortar lining for water: ANSI 21.4.
  - 2. Rubber gasket joints: ANSI 21.11.
  - 3. Ductile iron pipe thickness: ANSI A-21.50.
  - 4. Ductile iron pipe centrifugally cast in metal or sand lined molds: ANSI A-21.51.
  - 5. Cast iron pipe flanges and fittings: ANSI B-16.1.
  - 6. Threaded flanges: CIPRA standard.
  - 7. Cast and ductile iron fittings: ANSI A-21.10.
  - 8. Fusion-bonded polyethylene lining for water ANSI/ASTM D1248.
- B. Qualifications: All ductile iron pipe and cast iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed,



installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

- C. Manufacturer: Pipe shall be as manufactured by the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, or equal.

### 1.03 SUBMITTALS

#### A. Materials and Shop Drawings:

- 1. Shop Drawings, including layouts within, and under buildings and structures shall be submitted to the Engineer for approval in accordance with General Conditions and Section 01340: Shop Drawings, Working Drawings and Samples and the following. Shop Drawings shall be prepared by the pipe manufacturer.

#### B. Additional Information:

- 1. Tabulated layout schedule including:
  - a. Order of installation and closures.
  - b. Pipe invert elevation and station at each change of grade and alignment.
  - c. Elements of curves and bends, both in horizontal and vertical alignment, including elements of the resultant true angular deflections in cases of combined curvature.
  - d. The limits of each reach of pipe thickness class and of restrained joints.
  - e. The limits of each reach of concrete encasement or encasement in casing.
  - f. Locations of closures for length adjustment and for construction convenience.
  - g. Locations of manholes and other points of access for placement of mortar lining a field joints and removal of test bulkheads.
  - h. Locations of valves and other mechanical equipment.
  - i. Methods and locations of supports.

2. Details of special elbows and fittings.
3. Calculations and test data demonstrating that the proposed restrained joint arrangement can transmit the required forces.
4. Copy of the manufacturer's quality control check of pipe material and production.
5. Provide an affidavit of compliance with AWWA standards referenced in this specification.

C. Operating Instructions (Not Applicable)

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All pipe shall be shipped and stored at the jobsite with wood lagging between pipes such that pipes do not make contact with one another.
- B. Exercise extra care when handling epoxy, cement, and polyethylene lined pipe and fittings. Damage to the lining will render it unfit for use.

1.05 WARRANTY AND GUARANTEES

- A. The manufacturer's written warranty shall be submitted for all major pieces of equipment, as specified in Section 01740: Warranties and Bonds. The manufacturer's warranty period shall be concurrent with the Contractor's correction period for 1 year after the time of completion and acceptance.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All materials that come into contact with potable water, the water being treated, or the finished water shall be on either the EPA or NSF lists of products approved for use in contact with potable water. Manufacturers shall submit an affidavit with the shop drawings indicating approval by the EPA or NSF for the materials used in products that come into contact with the water, in accordance with Rule 62-555 FAC.
- B. All joints in pressurized piping systems for the plant yard piping shall be restrained. The use of thrust blocks for achieving thrust restraint shall not be allowed.

2.02 MATERIALS AND EQUIPMENT

- A. Pipe - Ductile Iron Pipe Conforming to ANSI A21.51 and AWWA C151:
  1. Unless otherwise shown on the Drawings, the minimum thickness of ductile iron pipe shall be:

- a. For buried pipe:
    - 1) Pipe shall be the following minimum Thickness Class unless otherwise noted or specified:
      - i. 3-inch diameter: Minimum wall thickness 0.25 inch
      - ii. 4-inch diameter: Thickness Class 51.
      - iii. 6-inch and larger diameter: Thickness Class 50.
  - b. For pipe with flanges (all above ground or exposed piping): Thickness Class 53.
- 2. Pipe for use with sleeve type couplings or mechanical parts shall have plain ends (without bells or beads) cast or machined at right angles to the axis.
  - 3. Pipe for use with split type couplings shall have ends with cast or machined shoulders or grooves that meet the requirements of the coupling manufacturer.
  - 4. Pipe shall be supplied in lengths not in excess of 20 feet having rubber-ring type push-on joints, standard mechanical joints or restrained joints where required for underground piping and flanged joint piping, for all above ground piping as shown on the Drawings.
  - 5. Coatings and Linings:
    - a. Wastewater Service Interior Lining: All ductile iron pipe, fittings, and specials for force mains shall be lined with Protecto 401 Ceramic Epoxy Pipe Coating with a minimum dry film thickness of 40 mils applied by the pipe manufacturer. Storage, surface preparation, application, and safety precautions shall strictly follow manufacturer's instructions.
    - b. Potable and Reuse Service Lining: All ductile iron pipe, fittings, and specials for water and reuse mains shall have an interior protective lining of cement-mortar with a seal coat of asphaltic material in accordance with ANSI/AWWA A21.4/C104.
    - c. Exterior Coatings for Buried Pipe (wastewater, potable, and reuse service): Ductile iron pipe, fittings, and specials to be installed underground shall be coated on the exterior at the factory with an asphaltic coating approximately 1 mil thick as specified in AWWA C151.

6. Color Identification:

- a. Ductile iron pipe used for potable water service shall have blue colored stripes added to pipe exterior to identify pipe service as specified in the Piping Schedule and in accordance with F.A.C 62-555.320(21)(b)(3).

B. Fittings: All ductile iron pipe fittings shall be ductile iron with a minimum pressure rating as follows:

1. Fittings shall be either mechanical joint or push-on restrained joint as indicated on the Drawings and shall have a minimum working pressure of 250 psi. Fittings shall be ductile iron and shall conform to ANSI/AWWA C110/A21.10, ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53, latest revisions for mechanical joint pipe. Fittings shall be coated and lined in the manner specified above for ductile iron pipe. The rubber gaskets for mechanical and push-on joints shall be as described below.

C. Joints (as shown on the Drawings and as specified):

1. General: Joints in "runs" of aboveground piping or piping located in vaults and structures shall be flanged. Joints in "runs" of buried piping shall be of the push-on or mechanical joint type per AWWA C-111 except where flanged joints are required to connect to valves, meters, and other equipment.
2. Flanges:
  - a. Flanges shall be Class 125 per ANSI B-16.1 unless otherwise specifically noted.
  - b. Gaskets: Fullface, 1/8 inch thick, cloth-inserted rubber:
    - 1) Potable Water: Gaskets to be furnished in rubber suitable for potable water service, suitable for use with chloramines, and Certified to NSF Standard 61.
    - 2) All Other: gaskets to be furnished in Buna-N rubber suitable for sewage and water service.
  - c. Bolts and Nuts for Flanges:
    - 1) Bolts and nuts for flanges located in enclosed vaults and within structures, basins, or wetwells, buried and submerged and shall be Type 316 stainless steel conforming to ASTM A-193, Grade B8M for bolts, and ASTM A-194, Grade 8M for nuts. Bolts and nuts located outdoors above ground shall be hot dipped galvanized steel, hex heavy.

- 2) Provide washers for each nut. Washers shall be of the same material as the nuts.
  - d. Provide specially drilled flanges when required for connection to existing piping or special equipment.
  - e. Flanges shall be long-hub type screwed tightly on pipe by machine at the foundry prior to facing and drilling. Flange faces shall be coated with a rust inhibitor immediately after facing and drilling. Field assembled screwed on flanges are prohibited.
3. Mechanical Joints:
- a. Jointing materials for mechanical joints shall be provided by the pipe and fitting manufacturer. Materials assembly and bolting shall be in strict accordance with ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53, latest revisions. Tee head bolts and nuts for mechanical joints shall be manufactured of high strength, low alloy steel in accordance with ANSI/AWWA C111/A21.11. The plain ends of push-on pipe shall be factory, machined to a true circle and chamfered to facilitate fitting the gasket.
  - b. Each joint shall be complete with rubber gasket, cast iron gland and all required bolts and nuts.
  - c. Gaskets:
    - 1) Potable Water: gaskets to be furnished in EPDM rubber suitable for potable water service, suitable for exposure to chloramines, and NSF 61 certified.
    - 2) All Other: gaskets to be furnished in Buna-N rubber suitable for sewage and water service.
- D. Restrained Joints: Restrained joints on pipe and fittings shall be provided for all buried piping systems as indicated on the Drawings to restrain system thrust. Pipe joints and fittings shall be restrained as specified below. It is intended that all buried joints be restrained.
1. Manufactured Restrained Joints: Manufactured restrained joints shall be Flex-Ring, Lok-Ring or Lok-Fast manufactured by the American Cast Iron Pipe Company, Lok-Tyte or Tr-Flex Type manufactured by the United States Pipe Company or an equal approved by the Engineer. Joints shall be manufacturer's standard specifically modified push-on type joints with joint restraint provided by ductile iron retainer rings joined together by corrosion resistant, high strength steel tee head bolts and nuts or with joint restraint provided by a welded-on retainer ring and a split flexible ring assembled behind the retainer ring.

2. Restrained joint pipe and fittings shall be ductile iron only and shall comply with applicable portions of this specification. Manufactured restrained joints shall be capable of deflection during assembly. Deflection shall not exceed 80 percent of the manufacturer's recommendations.
  3. Tee head bolts and nuts for restrained joints shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel as manufactured by NSS Industries, Plymouth, Michigan, or an equal approved by the Engineer.
- E. Alternate Restrained Joints: When prior approval is obtained from the Engineer, ductile iron pipe and fittings with mechanical joints may be restrained using a follower gland, which includes a restraining mechanism. When actuated during installation, the restraining device shall impart multiple wedging action against the pipe wall, which increases resistance as internal pressure in the pipeline increases.
1. The joint shall maintain flexibility after installation. Glands shall be manufactured of ductile iron conforming to ASTM A536 and restraining devices shall be of heat treated ductile iron with a minimum hardness of 370 BHN. The gland shall have standard dimension and bolting patterns for mechanical joints conforming to ANSI/AWWA C111 and C153, latest revisions.
  2. Tee head bolts and nuts shall be manufactured of corrosion resistant, high strength, low alloy CORTEN steel in accordance with ASTM A242.
  3. The restraining wedges shall have twist-off nuts to insure proper torquing. The mechanical joint restraint device shall have a minimum working pressure rating of 250 psi with a minimum safety factor of 2 to 1 and shall be MEGALUG<sup>®</sup> as manufactured by EBBA Iron, Inc. No other retainer gland type device will be acceptable. After installation prior to backfilling, all parts of the joint restraint system shall be coated with coal tar epoxy equal to Kop-Coat Bitumastic No. 300-M."

## 2.03 ACCESSORIES

### A. Outlets:

1. For outlets larger than 2 inches, provide a tee with a flanged outlet.
2. Provide outlets 2 inches and smaller by tapping and attaching a service clamp.

## PART 3 - EXECUTION

### 3.01 PREPARATION (Not Applicable)

### 3.02 INSTALLATION

#### A. Assembling joints:

##### 1. Push-on joints:

- a. Insert the gasket into the groove of the ball.
- b. Uniformly apply a thin film of special lubricant over the inner surface of the gasket that will contact the spigot end of the pipe.
- c. Insert the chamfered end of the plain pipe into the gasket and push until it seats against the bottom of the socket.

##### 2. Bolted joints:

- a. Remove rust preventative coatings from machined surfaces prior to assembly.
- b. Thoroughly clean and carefully smooth all burrs and other defects from pipe ends, sockets, sleeves, housings and gaskets.

##### 3. Grooved end joints:

- a. Install grooved end pipe and fittings in accordance with the coupling manufacturer's recommendations and the following.
- b. Clean loose scale, rust, oil, grease, and dirt from the pipe or fitting groove before installing coupling. Apply the coupling manufacturer's gasket lubricant to the gasket exterior, including lips, pipe ends, and housing interiors.
- c. Fasten coupling alternately and evenly until coupling halves are seated. Use torques as recommended by the coupling manufacturer.

##### 4. Flanged joints:

- a. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing, lubricate bolts with oil and graphite.

- b. Insert the nuts and bolts (or studs) finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
- c. Execute care when tightening joints to prevent undue strain upon valves, pumps and other equipment.
- d. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

5. Mechanical joints:

- a. Thoroughly clean, with a wire brush, surfaces that will be in contact with the gaskets.
- b. Lubricate the gasket, bell and spigot by washing with soapy water.
- c. Slip the gland and gasket, in that order, over the spigot and insert the spigot into the bell until properly sealed.
- d. Evenly seat the gasket in the bell at all points, center the spigot, and firmly press the gland against the gasket.
- e. Insert the bolts, install the nuts finger tight, and progressively tighten diametrically opposite nuts uniformly around the joints to the proper tension with a torque wrench.

B. Fabrication:

1. Tapped connections:

- a. Make all tapped connections as shown on the Drawings or as directed by the Engineer.
- b. Make all connections watertight and of adequate strength to prevent pullout.
- c. Drill and tap normal to the longitudinal axis of the pipe.

2. Cutting:

- a. Perform all cutting with machines having rolling wheel cutters or knives designed to cut ductile iron. The use of a hammer and chisel to cut pipe is prohibited.
- b. After cutting, examine all cut ends for possible cracks.



- c. Carefully chamfer all cut ends to be used with push-on joints to prevent damage to gaskets when pipe is installed.

C. Installing Buried Piping:

1. Inspect each pipe and fitting before lowering the buried pipe or fitting into the trench. Inspect the interior and exterior protective coatings. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
2. Handle pipe in a manner to avoid any damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.
3. When installing piping in trenches, do not deviate more than 1-inch from line or 1/4 inch from grade. Measure for grade at the pipe invert.
4. Grade the bottom of the trench by hand to the line and grade to which the pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent a uniform thickness of bedding. Before laying each section of the pipe, check the grade with a straightedge and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of lifting tackle.
5. At the location of each joint, dig bell (joint) holes of dimensions in the bottom of the trench and at the sides to permit visual inspection of the entire project.
6. Keep the trench in a dewatered condition during pipelaying in accordance with Section 02200: Earthwork.
7. When the pipelaying is not in progress, close the open ends of pipe. Do not permit trench water, animals, or foreign material to enter the pipe.

D. Pipe deflection:

1. Push-on and mechanical joints:
  - a. The maximum permissible deflection of alignment at joints shall not exceed 75% of the manufacturer's recommended deflection.

E. Hydrostatic Testing: Test in accordance with Section 15044: Pressure Testing of Piping. Test pressures are shown in the Piping Pressure Test Schedule, Table 15044-A of Section 15044.

### 3.03 INSPECTION AND TESTING

- A. All pipe shall be inspected and tested at the foundry.
- B. The Owner shall have the right to have any or all piping, fittings or special castings inspected and tested by an independent testing agency at the foundry or elsewhere. Such inspection and testing will be at the Owner's expense.
- C. Mark as rejected and immediately remove from the job site, all pipe lengths showing a crack, damaged lining, or receiving a severe blow that may cause an incipient fracture, even though no such fractures can be seen.
- D. Removal of cracked portions:
  - 1. Any pipe showing a distinct crack, but no incipient fracture beyond the limits of the visible crack, may be cut off and the sound portion installed. Cut the pipe at least 12 inches from the visible limits of the crack. Cutting of pipe shall be done by skilled workmen, and in such a manner as to not damage the pipe. Every cut shall be square and smooth, with no damage to the pipe lining. Cut surfaces, shall be recoated as specified for the pipe.
  - 2. Cutting and installing cracked pipe shall only be performed when approved by the Engineer, and shall be at the expense of the Contractor.
- E. Carefully inspect and hammer test all pipe and fittings prior to installation.

### 3.04 DISINFECTION

- A. All ductile iron piped used for potable water service is to be disinfected in accordance with Section 15041.

END OF SECTION

## SECTION 15070

### SCHEDULE 80 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals required, and install and test in the locations as shown on the Drawings, the Schedule 80 polyvinyl chloride piping, fittings and appurtenances specified herein.
2. Schedule 80 PVC piping shall be used on all small diameter PVC piping systems (3 inches and smaller in diameter) which includes, but are not limited to, chlorine solution, non-potable water, potable water and, other chemical feeds.
3. All plastic pipe and fittings shall conform to this specification section whether provided as a part of an equipment "package" or purchased separately by the contractor.

###### B. Related Work Described Elsewhere:

1. Piping, Valve and Equipment Identification System: Section 09905.
2. Mechanical – General Requirements: Section 15000.
3. Pressure Testing of Piping: Section 15044.
4. PVC Double Wall Containment Piping: Section 15076.
5. Chemical Feed System Piping: Section 15090.
6. Valves and Appurtences: Section 15100.
7. Pipe Hangers and Supports: Section 15126.
12. Couplings and Connectors: Section 15129.

###### C. General Design:

1. Schedule 80 PVC piping shall be installed in the locations as shown on the Drawings. All plastic pipe and fittings shall conform to this specification section whether provided as a part of an equipment "package" or purchased separately by the Contractor.

2. All 3-inch diameter pipe and smaller, shall be made of polyvinyl chloride unless specifically noted otherwise on the Drawings or in other sections of the specifications.
4. All PVC pipe used for potable water lines shall be predominately blue in color. Underground PVC pipes used for potable water lines shall be solid-wall blue pipe, will have a co-extruded blue external skin, or will be white or black pipe with blue stripes incorporated into, or applied to, the pipe wall. PVC pipes used for raw water shall be white in color. PVC pipes used for non-potable irrigation, reclaimed or reuse water shall be purple in color.
5. Construct concrete encasements only with written permission from the Water Director.

#### 1.02 QUALITY ASSURANCE

- A. All plastic pipe, fittings and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications. The equipment shall be manufactured by Spears, IPEX, or an Engineer approved equal.

#### 1.03 SUBMITTALS

##### A. Materials and Shop Drawings:

1. Shop drawings shall be submitted to the Engineer for approval in accordance with the General Conditions and Section 01340. All products within this specification shall be combined into a single submittal which shall include at least the following:
  - a. Dimensioning and the technical specifications for all piping, fittings, and appurtenances to be furnished.
  - b. Where special designs or fittings are required, show the work in large detail and completely describe and dimension all items.
  - c. Letter of Certification from the National Sanitation Foundation International (NSF) stating compliance with Standard 14 and Standard 61.
  - d. Letter from the Manufacturer verifying chemical compatibility of all products to be used in chemical feed systems.

##### B. Additional Information:

1. Submit to the Engineer, for approval, samples of all materials specified herein, along with the manufacturer's Certificates of Inspection, descriptive literature, illustrations, specifications, installation instructions and related information.

#### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. PVC pipe shall be delivered to the site in unbroken bundles packaged in such manner as to provide protection against damage. When possible pipe should be stored at the job site in the unit packages until ready for use. Packaged units shall be handled using a forklift or a spreader bar with fabric straps. Packaged units shall not be stacked at the job site higher than two units high.
- B. When it is necessary to store PVC pipe for more than 30 days, exposure to direct sunlight shall be prevented by covering the pipe with an opaque material. Adequate air circulation above and around the pipe shall be provided as required to prevent excessive heat accumulation. PVC pipe shall not be stored close to heat sources or hot objects such as heaters, fires, boilers or engine exhaust. Pipe gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil and grease. The interior and all sealing surfaces of pipe, fittings and other appurtenances shall be kept clean and free of dirt and foreign matter.
- C. Care shall be taken in handling and laying pipe and fittings to avoid severe impact blows, crushing, abrasion damage, gouging or cutting. Pipe shall be lowered, not dropped, from trucks or into trenches. All cracked, damaged or defective pipe and fittings, or any length of pipe having a gouge, scratch or other permanent indentation of more than 10 percent of the wall thickness in depth, shall be rejected and removed at once from the work and replaced with new acceptable pipe at no additional cost to the Owner.

#### 1.05 WARRANTY AND GUARANTEES

- A. Provide equipment warranty in accordance with Section 01740: Warranties and Bonds.

### PART 2 - PRODUCTS

#### 2.01 GENERAL

- A. All materials that come into contact with the water being treated or the finished water shall be on either the EPA or NSF lists of products approved for use in contact with potable water. Manufacturers shall submit an affidavit with the shop drawings indicating approval by the EPA or NSF for the materials used in products that come into contact with the water, in accordance with Rule 62-555.320(3) Florida Administrative Code.

#### 2.02 MATERIALS AND EQUIPMENT

- A. PVC Pipe:

1. Pipe shall be made of polyvinyl chloride, Schedule 80 pipe, conforming to ASTM D1785. Schedule 80 pipe shall have solvent welded joints. Threaded connections are permissible when connecting to valves or other equipment where solvent weld connections are not an option. In no cases is connection of PVC female threads to metal male threads allowable.
2. Provide mark on each pipe at internals of 5 feet or less to designate compliance with applicable ASTM or AWWA specification.

B. Fittings:

1. Fittings for Schedule 80 pipe 4 inches and smaller in diameter shall be socket type, solvent welded in conformance with ASTM D 2467. When permitted, threaded joints shall be in conformance with ASTM D 2464. Solvent welded and threaded joints shall be watertight. Chlorine gas vacuum feed lines and chlorine solution lines shall have solvent welded fittings.
2. Fittings for Schedule 80 pipe greater than 4 inches in diameter shall be socket type, solvent welded in conformance with ASTM D 2467. Fittings shall be a 1-piece injection molded design. Use of low pressure fabricated PVC fittings will not be permitted.

C. Solvent Cement:

1. PVC solvent cement shall be in compliance with ASTM D 2564.
2. Solvent cement shall be specified by compatibility based on pipe service and size. Large diameter joints shall be solvent welded with slow setting solvent cement.
3. Manufacturer to provide certification with submittal.
4. All PVC chemical feed piping joints are to be solvent welded using CPVC solvent cement.

D. Flanges:

1. Slip-on flanges shall be provided to connect to flanged valves, fittings, or equipment. Flanges shall match the connecting flanges on the adjacent fitting, valve or piece of equipment and must meet the test pressure of the piping system as specified in Section 15044.
3. Flange hardware (bolts, nuts, and washers) for PVC flanges shall be Type 316 stainless steel in accordance with ASTM F593 and F594, respectively. Flange hardware for PVC flanges on Sodium Hypochlorite and Hydrofluorosilicic Acid piping shall be Hastelloy C-276, Ammonium Sulfate piping shall be titanium, and sodium hydroxide piping shall be ASI Type 316 SST. The length such that, after

installation, bolts will project 1/8 to 3/8 inch beyond the outer face of the nut. Flat Washers shall be of the same material as the bolts.

4. Flange gaskets shall be EPDM for water service. For chemical feed piping systems, the gasket material shall be viton for Sodium Hypochlorite and Hydrofluorosilicic Acid piping, and EPDM for Sodium Hydroxide and Ammonium Sulfate piping.

E. Temporary Bulkheads

1. Provide temporary bulkheads at the ends of sections where adjoining pipelines have not been completed and are not ready to connect. Remove all temporary bulkheads when they are no longer needed.

2.03 ACCESSORIES (NOT APPLICABLE)

2.04 SPARE PARTS

- A. All special tools, solvents, lubricants, and cements required for normal installation shall be furnished with the pipe.

2.05 QUALITY CONTROL

- A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for project.
- B. Provide pipe and fitting manufactured no earlier than 12 month period proceeding the date of the Agreement.

PART 3 - EXECUTION

3.01 PREPARATION (NOT APPLICABLE)

3.02 INSTALLATION

- A. Install PVC pipe where shown on the Drawings and in strict accordance with the manufacturer's technical data and printed instructions.
- B. Joints for Schedule 80 PVC pipe and fittings shall be solvent welded, flanged, or threaded. All joints shall be made watertight. All pipe cutting, threading and jointing procedures for solvent welded and threaded PVC pipe joints shall be in strict accordance with the pipe and fittings manufacturer's printed installation instructions. Thread lubricant for threaded joints shall be Teflon tape only. In making solvent welded connections, clean dirt and moisture from pipe and fittings, bevel pipe ends slightly with emery cloth, if necessary and apply solvent cement of proper grade.

- C. Installation of valves and fittings shall be strictly in accordance with the manufacturer's instructions. Particular care shall be taken not to over-stress threaded connections at sleeves. In making solvent weld connections the solvent shall not be spilled on valves or allowed to run from joints.
- D. All piping shall have sufficient number of unions to allow convenient removal and shall be as approved by the Engineer.
- E. Concrete inserts for hangers and supports shall be furnished and installed in the concrete as it is placed. The inserts shall be set in accordance with the requirements of the piping layout and the Contractor shall verify their locations from approved piping layout Drawings and the structural Drawings. Pipe hangers and supports are specified in Section 15126.
- F. Field Painting:
  - 1. Pipe normally exposed to view shall be painted and marked as specified in Section 09905: Piping, Valve and Equipment Identification System.
- G. Jointing:
  - 1. Clean each pipe length, coupling and fitting of all debris and dirt before installation.
  - 2. Do not use pipe length if there are any cuts, abrasions, or defects on the surface of the pipe.
  - 3. Provide and use coupling pullers for joining the pipe when required.
  - 4. Shove home each length of pipe against the pipe previously laid and hold securely in position.
  - 5. Do not pull or cramp joints.



H. Fabrication:

1. Cutting:

- a. Use a hand saw or pipe cutter with blades (not rollers).
- b. Examine all cut ends for possible cracks caused by cutting.

2. Connecting:

- a. Solvent weld connections are recommended by the manufacturer.
- b. Connect pipe and fittings only when temperature is above the minimum recommended by the manufacturer.
- c. Threaded adapters shall be connected only with plastic male into metal female.

3.03 INSPECTION AND TESTING

- A. All PVC piping shall be hydrostatically pressure tested and flushed in accordance with the requirements in Section 15044: Pressure Testing of Piping.

3.04 START-UP AND INSTRUCTION (NOT APPLICABLE)

END OF SECTION

## SECTION 15126

### PIPE HANGERS AND SUPPORTS FOR PROCESS PIPING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals and install pipe hangers, supports, concrete inserts, and anchor bolts including all metallic hanging and supporting devices for supporting exposed piping.

###### B. Related Work Described Elsewhere:

1. Concrete is included in Division 3.
2. Metal fabrications are included in Division 5.
3. Painting is included in Section 09961.
4. Pipe and fittings are included in respective sections of Division 15.
5. Mechanical - General Requirements: Section 15000.

###### C. General Design (Not Applicable)

##### 1.02 QUALITY ASSURANCE

- A. Hangers and supports shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for pipe supports shall be five (5) times the ultimate tensile strength of the material, assuming 10 feet of water filled pipe being supported.
- B. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit a certification stating that such requirements have been complied with.

### 1.03 SUBMITTALS

#### A. Materials and Shop Drawings:

1. Submit to the Engineer for approval, as provided in Section 01340: Shop Drawings, Working Drawings, and Samples, shop drawings of all items to be furnished under this Section.
2. Submit to the Engineer, for approval, samples of all materials specified herein.

### 1.04 PRODUCT DELIVERY STORAGE AND HANDLING

- #### A.
- The equipment provided under this section shall be shipped, handled and stored in accordance with the Manufacturer's written instructions, and in accordance with Section 01600: Materials and Equipment.

### 1.05 WARRANTY AND GUARANTEES

- #### A.
- Provide equipment warranty in accordance with Section 01740: Warranties and Bonds.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- #### A.
- All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, and fittings and to support and cure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. All pipe supports shall be approved prior to installation.
- #### B.
- The Contractor shall select and design all piping support systems within the specified spans and component requirements. Structural design and selection of support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation. Commercial pipe supports and hangers shall have a minimum safety factor of 5.
- #### C.
- No attempt has been made to show all required pipe supports in all locations, either on the Drawings or in the details. The absence of pipe supports and details on any drawings shall not relieve the Contractor of the responsibility for providing them throughout the plant.
- #### D.
- All support anchoring devices, including anchor bolts, inserts and other devices used to anchor the support onto a concrete base, roof, wall or structural steel works, shall be of the proper size, strength and spacing to withstand the shear and pullout loads imposed by loading and spacing on each particular support.

- E. All materials used in manufacturing hangers and supports shall be capable of meeting the respective ASTM Standard Specifications with regard to tests and physical and chemical properties, and be in accordance with MSS SP-58.
- F. Hangers and supports shall be spaced in accordance with ANSI B31.1.0 except that the maximum unsupported span shall not exceed 10 feet unless otherwise specified herein.
- G. Unless otherwise specified herein, pipe hangers and supports shall be as manufactured by ITT Grinnel Co., Inc., Carpenter and Patterson, Inc., or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product, and shall not be considered as proprietary. Any item comparable in type, style, quality, design and performance will be considered for approval.

## 2.02 MATERIALS AND EQUIPMENT

### A. Pipe Hangers and Supports for Metal Pipe:

- 1. Suspended single pipes shall be supported by hangers suspended by steel rods from galvanized concrete inserts, beam clamps, or ceiling mounting bolts as follows:

#### a. Hangers

<u>Pipe Size, Inches</u>	<u>Grinnel Fig. No.</u>
Less than 1/2	138R
1/2 through 1	97C
1-1/4 through 4	104
6 through 12	590
14 through 30	171

- b. Hanger rods shall be rolled steel machine threaded with load ratings conforming to ASTM Specifications and the strength of the rod shall be based on root diameter. Hanger rods shall have the following minimum diameters:

<u>Pipe Size, Inches</u>	<u>Min. Rod Diameter, In.</u>
Less than 2-1/2	3/8
2-1/2 to 3	1/2
4	5/8
6	3/4
8 to 12	7/8
14 to 18	1

- c. Where applicable, structural attachments shall be beam clamps. Beam clamps, for rod sizes 1/2-inch through 3/4-inch shall be equal to Grinnel Fig. No. 229, and for rod sizes 7/8-inch through 1-1/4 inches shall be equal to Grinnel Fig. No. 228, or equal.

- d. Concrete inserts for pipe hangers shall be; continuous metal inserts designed to be used in ceilings, walls or floors, spot inserts for individual pipe hangers, or ceiling mounting bolts for individual pipe hangers and shall be as manufactured by Unistrut Corp., Wayne, Michigan; Carpenter and Patterson, Inc., Laconia, New Hampshire; Richmond or equal and shall be as follows:
    - 1) Continuous concrete inserts shall be used where applicable and/or as shown on the Drawings and shall be used for hanger rod sizes up to and including 3/4-inch diameter. Inserts to be used where supports are parallel to the main slab reinforcement shall be Series P3200 by Unistrut Corp., Fig 1480 Type 2 by Carpenter and Patterson, Inc., or equal. Inserts to be used where supports are perpendicular to the main slab reinforcement shall be Series P3300 by Unistrut Corp., Fig. 1480 Type I by Carpenter and Patterson, Inc. or equal.
    - 2) Spot concrete inserts shall be used where applicable and shall be used for hanger sizes up to and including 7/8-inch diameter. Inserts shall be Fig. 650 by Carpenter and Patterson, Inc. for hanger rod sizes 1/2-inch through and including 3/4-inch, and Fig. 266 by Carpenter and Patterson Inc., for 7/8-inch hanger rods.
    - 3) Ceiling mounting bolts shall be used where applicable and be for hanger rod sizes 1-inch through and including 1-1/4 inches and shall be Fig. 104M as manufactured by Carpenter and Patterson, Inc., or equal.
  - e. All pipe hangers shall be capable of vertical adjustment under load and after erection. Turnbuckles, as required and where applied, shall be equal to Grinnel Fig. No. 230.
2. Wall or column supported pipes shall be supported by welded steel brackets equal to Grinnel Fig. 194, 195 and 199 as required, for pipe sizes up to and including 20-inch diameter. Additional wall bearing plates shall be provided where required.
- a. Where the pipe is located above the bracket, the pipe shall be supported by an anchor chair and U-bolt assembly supported by the bracket for pipes 4 inches and larger and by a U-bolt for pipes smaller than 4 inches. Anchor chairs shall be equal to Carpenter Patterson Fig. No. 127. U-bolts shall be equal to Grinnel Fig. No. 120 and 137.
  - b. Where the pipe is located below the bracket, the pipes shall be supported by pipe hangers suspended by steel rods from the bracket. Hangers and steel rods shall be as specified above.

3. Floor supported pipes 3-inches and larger in diameter shall be supported by either cast-in-place concrete supports or adjustable pipe saddle supports as directed by the Engineer. In general, concrete supports shall be used when lateral displacement of the pipes is probable (unless lateral support is provided), and adjustable pipe saddle type supports shall be used where later displacement of pipes is not probable.
  - a. Each concrete support shall conform to the details shown on the Drawings. Concrete shall be poured after the pipe is in place with temporary supports. Concrete piers shall conform accurately to the bottom  $\frac{1}{3}$  to  $\frac{1}{2}$  of the pipe. Top edges and vertical corners of each concrete support shall have 1-inch bevels. Each pipe shall be secured on each concrete support by a wrought iron or steel anchor strap anchored to the concrete with cast-in-place bolts or with expansion bolts. Where directed by the Engineer, vertical reinforcement bars shall be grouted into drilled holes in the concrete floor to prevent overturning or lateral displacement of the concrete support. Unless otherwise approved by the Engineer, maximum support height shall be five (5) feet.
  - b. Concrete piers used to support base elbows and tees shall be similar to that specified above. Piers may be square or rectangular.
  - c. Each adjustable pipe saddle support shall be screwed or welded to the corresponding size 150 pound companion flanges or slip-on welding flanges respectively. Supporting pipe shall be of Schedule 40 steel pipe construction. Each flange shall be secured to the concrete floor by a minimum of two (2) expansion bolts per flange. Adjustable saddle supports shall be equal to Grinnel Fig. No. 264. Where used under base fittings, a suitable flange shall be substituted for the saddle.
4. Vertical piping shall be supported as follows:
  - a. Where pipes change from horizontal to vertical, the pipes shall be supported on the horizontal runs within 2 feet of the change in direction by pipe supports as previously specified herein.
  - b. For vertical runs exceeding 15 feet, pipes shall be supported by approved pipe collars, clamps, brackets, or wall rests at all points required to insure a rigid installation.
  - c. Where vertical piping passes through a steel floor sleeve, the pipe shall be supported by a friction type pipe clamp which is supported by the pipe sleeve. Pipe clamps shall be equal to Grinnel Fig. 262.
5. Anchor bolts shall be equal to Kwik-Bolt as manufactured by the McCulloch Industries, Minneapolis, Minnesota, or Wej-it manufactured by Wej-it Expansion Products, Inc., Bloomfield, Colorado.

6. All rods, hangers, inserts, brackets, and components shall be furnished with galvanized finish.

B. Pipe Hangers and Supports for Plastic Pipe:

1. Single plastic pipes shall be supported by pipe supports as previously specified herein.
2. Multiple, suspended, horizontal plastic pipe runs, where possible, and rubber hose shall be supported by ladder type cable trays such as the Electray Ladder by Husky-Burndy, the Globetray by the Metal Products Division of United States Gypsum, or equal. Ladder shall be of mild steel construction. Rung spacing shall be approximately 18 inches for plastic pipe and 12 inches for rubber hose. Tray width shall be approximately 6-inch for single runs of rubber hose and 12 inches for double runs of rubber hose. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc. required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners equal to Globe Model M-CAC, Husky-Burndy Model SCR or approved equal. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe.
3. Individual clamps, hangers, and supports in contact with plastic pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

C. Pipe Supports for Small Diameter PVC and Steel Pipe:

1. Small diameter Schedule 80 PVC piping 3-inches in diameter and smaller, and steel piping 2-inches in diameter and smaller shall be supported with "SUSPORT" system arrangements as manufactured by Universal Suspension Systems Inc. of Gillette, New Jersey or an equal approved by the Engineer. Clamping halves for the pipe support shall be manufactured of molded polypropylene and shall support and fit closely for 360° around the pipe. To support piping carrying non-corrosive fluids or gases and located in noncorrosive, indoor environments, all hardware for the "SUSPORT" system shall be nickel chrome plated carbon steel. To support piping carrying corrosive fluids or gases, piping located in corrosive environments or piping located outdoors, all hardware for the system shall be manufactured of Type 304 stainless steel.
2. In some cases, to adequately support small diameter PVC or steel piping, a metal frame support structure may be required for support of the "SUSPORT" system specified above. Where required, metal frame support structures shall be constructed using channels, fittings, brackets, hardware and other accessories as manufactured by B-Line Systems, Inc. of Highland, Illinois, or an equal approved by the Engineer. If located in indoor, non-corrosive

environments, the materials for the frame structure shall be carbon steel with an epoxy coating applied by a cathodic, electro-deposition process which is equal to "Dura-a-Green" by B-Line Systems, Inc. For corrosive or outdoor environments, the materials for the frame structure be Type 316 stainless steel unless otherwise noted on the Drawings. Hardware used to construct the frame support structure shall be cadmium plated for carbon steel supports or Type 316 stainless steel for stainless steel supports.

3. Pipe supports for small diameter PVC and steel piling shall be located wherever necessary in the opinion of the Engineer to adequately support the pipe, however, they shall have a maximum spacing as specified below for straight pipe runs. Adequate supports shall especially be used adjacent to valves and fittings in pipelines. The following table is based on spacing requirements for Schedule 80 PVC or Standard Weight (Schedule 40) steel pipe carrying a fluid with a Specific Gravity of 1.0 at a temperature not exceeding 120°F. Support spacing for PVC or steel piping carrying fluids with Specific Gravities or temperatures exceeding those stated above shall be approved by the Engineer.

Nominal Pipe Diameter, Inches	Support Spacing, Feet	
	PVC Pipe	Steel Pipe
1/2"	3.5	4.5
3/4"	4.0	5.0
1"	4.5	5.5
1-1/4"	5.0	6.5
1-1/2"	5.0	7.5
2"	5.5	8.0
2-1/2"	5.5	-
3"	6.0	-

2.03 ACCESSORIES (NOT APPLICABLE)

2.04 SPARE PARTS (NOT APPLICABLE)

2.05 QUALITY CONTROL

- A. Contractor shall follow Manufacturer's and Supplier's recommended product quality control specifics as required for this project.



## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Prior to prime coating, all pipe hangers and supports shall be thoroughly clean, dry and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer.
- B. All submerged pipe supports shall be prime coated with Koppers 654 Epoxy Primer or approved equal. All other pipe supports shall be prime coated with Rustinhibitive Primer No. 621 as manufactured by Koppers Company, Inc., Pittsburgh, Pa., or equal.
- C. Finish coating shall be compatible with the prime coating used and shall be applied as specified in Section 09961: High Performance Paints and Coatings.

### 3.02 INSTALLATION

- A. All pipes, horizontal and vertical, shall be rigidly supported from the building structure by approved supports. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or specified herein. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless it is so indicated on the Drawings, or specifically directed or authorized by the Engineer.
- B. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement, and pressure forces, thermal expansion and contraction, vibrations, and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Engineer.
- C. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings, and sleeve type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.
- D. Pipe supports shall be provided as follows:
  - 1. Cast iron and ductile iron shall be supported at a maximum support spacing of 10 feet, 0-inches with minimum of one support per pipe section at the joints.
  - 2. All vertical pipes shall be supported at each floor or at intervals of at least 15 feet by approved pipe collars, clamps brackets or wall rests, and at all points necessary to insure rigid construction.
- E. Effects of thermal expansion and contraction of the pipe shall be accounted for in pipe support selection and installation.
- F. Inserts for pipe hangers and supports shall be installed on forms before concrete is poured.

Before setting these items, all Drawings and figures shall be checked which have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.

- G. Continuous metal inserts shall be embedded flush with the concrete surface.
- H. Standard Pipe Supports:
  - 1. Horizontal Suspended Piping:
    - a. Single Pipes: Adjustable swivel-ring, splint-ring, or clevis hangers.
    - b. Grouped Pipes: Trapeze hanger systems.
    - c. Furnish galvanized steel protection shield and oversized hangers for all insulated pipe.
    - d. Furnish precut sections of rigid insulation with vapor barrier at hangers for all insulated pipe.
  - 2. Horizontal Piping Supported From Walls:
    - a. Single Pipes: Wall brackets or wall clips attached to wall with anchors. Clips attached to wall mounted framing also acceptable.
    - b. Stacked Piping:
      - 1) Wall mounted framing system and clips acceptable for piping smaller than 3-inch minimal diameter.
      - 2) Piping clamps which resist axial movement of pipe through support not acceptable.
    - c. Wall mounted piping clips not acceptable for insulated piping.
  - 3. Horizontal Piping Supported From Floors:
    - a. Stanchion Type:
      - 1) Pedestal type; adjustable with stanchion, saddle, and anchoring flange.
      - 2) Use yoke saddles for piping whose centerline elevation is 18 inches or greater above the floor and for all exterior installations.

- 3) Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.
  - b. Floor Mounted Channel Supports:
    - 1) Use for piping smaller than 3-inch nominal diameter running along floors and in trenches at piping elevations lower than can be accommodated using pedestal pipe supports.
    - 2) Attach channel framing to floors with anchor bolts.
    - 3) Attach pipe to channel with clips or pipe clamps.
  - c. Concrete Cradles: Use for piping larger than 3-inch along floor and in trenches at piping elevations lower than can be accommodated using stanchion type.
4. Vertical Pipe: Support with wall brackets and base elbow or riser clamps on floor penetrations.
5. Standard Attachments:
  - a. To Concrete Ceilings: Concrete inserts.
  - b. To Steel Beams: I-beam clamp or welded attachments.
  - c. To Wooden Beams: Lag screws and angle clips to members not less than 2-1/2 inches thick.
  - d. To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.
6. Existing Walls and Ceilings: Install as specified for new construction, unless shown otherwise.

3.03 INSPECTION AND TESTING (NOT APPLICABLE)

3.04 START-UP AND INSTRUCTION (NOT APPLICABLE)

END OF SECTION

## SECTION 15404

### GENERAL-DUTY VALVES FOR PLUMBING PIPING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Ball valves.

###### B. Related Sections:

1. Section 15425 - Plumbing Piping: Product and installation requirements for piping materials applying to various system types.
2. Section 15406 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for pipe hangers and supports.

##### 1.02 REFERENCES

###### A. ASTM International:

1. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
2. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

###### B. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

##### 1.03 SUBMITTALS

###### A. Section 01340 – Shop Drawings: Requirements for submittals.

###### B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

###### C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

###### D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of valves.
- C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

- A. For drinking water service, provide valves complying with NSF 61.
- B. Perform Work according to State of Florida's standards.
- C. Maintain one copy of each standard affecting Work of this Section on Site.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this Section with three years documented experience and approved by manufacturer.

1.07 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not install valves underground when bedding is wet or frozen.

## 1.10 WARRANTY

- A. Section 01700 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish five-year manufacturer warranty for valves excluding packing.

## PART 2 - PRODUCTS

### 2.01 BALL VALVES

- A. Manufacturers:
  - 1. Apollo
  - 2. Crane
  - 3. Nibco
  - 4. Substitutions: Approved Equal.
- B. 2 inches and Smaller: MSS SP 110, Class 150, bronze, two piece body, [type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder or threaded ends, lever handle.
- C. 2 inches and Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F ASTM D1785 PVC body and ball, double lever handle, EPDM seals, teflon seats, full port, double union type with socket or threaded ends.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify piping system is ready for valve installation.

### 3.02 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- D. Install valves with clearance for installation of insulation and allowing access.

- E. Provide access where valves and fittings are not accessible.
- F. Refer to Section 15406 for pipe hangers.
- G. Refer to Section 15425 for piping materials applying to various system types.

### 3.03 VALVE APPLICATIONS

- A. Install **ball** valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- B. Install ball valves in domestic water systems for shut-off service.

END OF SECTION15404

## SECTION 15406

### HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Flashing.
4. Sleeves.
5. Formed steel channel.

###### B. Related Sections:

1. Section 07900 - Joint Sealant: Product requirements for sealant materials for placement by this section.
2. Section 09900 - Painting and Coating: Product and execution requirements for painting specified by this section.
3. Section 15425 - Plumbing Piping: Execution requirements for placement of hangers and supports specified by this section.
4. Section 15430 - Facility Water Distribution: Execution requirements for placement of hangers and supports specified by this section.
5. Section 15440 - Facility Sanitary Sewerage: Execution requirements for placement of hangers and supports specified by this section.

##### 1.02 REFERENCES

###### A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.

###### B. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

###### C. FM Global:



1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

E. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

F. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.03 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

D. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.05 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.07 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.08 WARRANTY

- A. Section 01700 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Plumbing Piping - DWV:
  - 1. Conform to MSS SP58, and MSS SP69, MSS SP89.
  - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
  - 3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
  - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
  - 6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
  - 7. Vertical Support: Steel riser clamp.
  - 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
- B. Plumbing Piping - Water:
  - 1. Conform to MSS SP58, MSS SP69, and MSS SP89.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, Carbon-steel ring.

## 2.02 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

## 2.03 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Lead Flashing:
  1. Waterproofing: 5 lb./sq. ft sheet lead.
  2. Soundproofing: 1 lb./sq. ft sheet lead.
- D. Flexible Flashing: 47 mil thick sheet **butyl**; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

## 2.04 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

The following sealant may not be applicable for all applications. Edit the following for Project conditions.

- C. Sealant: Acrylic ; refer to Section 07900.

## 2.05 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.

### 3.02 PREPARATION

- A. Do not drill or cut structural members.

### 3.03 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with MSS SP 58, MSS SP 69, and MSS SP 89.
- B. Support horizontal piping as scheduled.
- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.
- F. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide copper plated hangers and supports for copper piping.

- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- K. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 15420.

#### 3.04 INSTALLATION - FLASHING

- A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor drains watertight to adjacent materials.
- E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

#### 3.05 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 3 inch above finished floor level. Caulk sleeves.
- E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with stuffing insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel escutcheons at finished surfaces.

3.06 CLEANING

- A. Section 01700 - Execution and Closeout Requirements: Requirements for cleaning.

3.07 PROTECTION OF FINISHED WORK

- A. Section 01700 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.08 SCHEDULES

- A. Pipe Hanger Spacing:
  - 1. Pipe Material: Copper tube.
    - a. Size: 1-1/4 inches and smaller.
    - b. Maximum Hanger Spacing: 6 feet
    - c. 1/2 inch
  - 2. Pipe Material: Copper tube.
    - a. Size: 1-1/2 inches and larger.
    - b. Maximum Hanger Spacing: 10 feet
    - c. 1/2 inch
  - 3. Pipe Material: PVC.
    - a. Maximum Hanger Spacing: 4 feet
    - b. 3/8 inch

END OF SECTION 15406

## SECTION 15410

### IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Nameplates.
2. Tags.
3. Pipe markers.

###### B. Related Sections:

1. Section 09900 - Painting and Coating: Execution requirements for painting specified by this section.

##### 1.02 REFERENCES

###### A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

###### B. National Fire Protection Association:

1. NFPA 99 - Standard for Health Care Facilities.

##### 1.03 SUBMITTALS

###### A. Section 01330 - Submittal Procedures: Submittal procedures.

###### B. Product Data: Submit manufacturers catalog literature for each product required.

###### C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

###### D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

###### E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.05 QUALITY ASSURANCE

- A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.
- B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.
- C. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.08 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.09 EXTRA MATERIALS

- A. Section 01700 - Execution and Closeout Requirements: Spare parts and maintenance products.



## PART 2 - PRODUCTS

### 2.01 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

### 2.02 TAGS

- A. Metal Tags:
  - 1. Aluminum with stamped letters; tag size minimum 1-1/2 inches square with finished edges.

### 2.03 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers
  - 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Pipe Markers
  - 1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Plastic Underground Pipe Markers
  - 1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

### 3.02 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.

- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install tags using corrosion resistant chain. Number tags consecutively by location.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- E. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify valves in main and branch piping with tags.
- H. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

### 3.03 SCHEDULES

- A. Identification:
  - 1. Domestic Cold Water Piping.
    - a. Background Color: White
    - b. Lettering Color: White
  - 2. Domestic Hot Water.
    - a. Background Color: White
    - b. Lettering Color: Red

END OF SECTION 15410

## SECTION 15425

### PLUMBING PIPING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:

1. Domestic water piping, within 5 feet of building.
2. Domestic water piping, above grade.
3. Sanitary sewer piping, within 5 feet of building.
4. Sanitary sewer piping above grade.
5. Unions and flanges.
6. Underground pipe markers.
7. Bedding and cover materials.

B. Related Sections:

1. Section 09900 - Painting and Coating: Product and execution requirements for painting specified by this section.
2. Section 15404 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
3. Section 15406 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.

##### 1.02 REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

A. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
4. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
5. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
6. ASME B31.9 - Building Services Piping.
7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM B32 - Standard Specification for Solder Metal.
2. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).

5. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
7. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
8. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
9. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
10. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
11. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
12. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
13. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

D. American Water Works Association:

1. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

### 1.03 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.
- C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

### 1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with **State** of Florida's standards.
- B. Maintain one copy each document on site.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this Section with minimum three years documented experience.

1.06 PRE-INSTALLATION MEETINGS

- A. Convene minimum **one** week prior to commencing Work of this Section.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.
- B. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.09 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 COORDINATION

- A. Section 01300 - Administrative Requirements: Requirements for coordination.
- B. Coordinate installation of buried piping with trenching.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Tubing: ASTM B42, Temper O61 annealed.
  - 1. Fittings: ASME B16.26 cast bronze.
  - 2. Joints: Flared.

2.02 DOMESTIC WATER PIPING, ABOVE GRADE

- A. PVC Pipe: ASTM D1785 Schedule 40 or ASTM D2241 SDR-26 for not less than 150 psi pressure rating, polyvinyl chloride (PVC) material.
  - 1. Fittings: ASTM D2466, Schedule 40, PVC.
  - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D1785, Schedule 80 polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.
  - 1. Fittings: ASTM D2467, Schedule 80, PVC.
  - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.04 SANITARY SEWER PIPING, ABOVE GRADE

- A. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material.
  - 1. Fittings: ASTM D2729, PVC.
  - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- B. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
  - 1. Fittings: ASTM D2665, PVC.
  - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

The following Article may be used for flue and combustion air piping with certain types of boilers or water heaters.

2.05 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
  - 1. Copper Piping: Class 150, bronze unions with soldered joints.
  - 2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
  - 3. PVC Piping: PVC.
- B. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.06 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type [A1] [A2] [A3] [A4] as specified in Section [02060310516] <\_\_\_\_\_>.

- B. Cover: Fill Type [A1] [A2] [A3] [A4], as specified in Section [02060310516] <\_\_\_\_\_>.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

#### 3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Remove scale and dirt on inside and outside before assembly.
- B. Prepare piping connections to equipment with flanges or unions.
- C. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

#### 3.03 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.
- B. Establish elevations of buried piping with not less than \_\_1\_\_\_\_ ft of cover.
- C. Establish minimum separation from other services piping in accordance with latest building code and Area Having Jurisdiction.
- D. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth;.
- E. Install pipe on prepared bedding.
- F. Route pipe in straight line.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
- I. Pipe Cover and Backfilling:
1. Maintain optimum moisture content of fill material to attain required compaction density.

2. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 4 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
3. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
4. Do not use wheeled or tracked vehicles for tamping.

#### 3.04 INSTALLATION - ABOVE GROUND PIPING

- A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- C. Group piping whenever practical at common elevations.
- D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 15406.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 15306.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 15420.
- G. Provide access where valves and fittings are not accessible.
- H. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- I. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.
- J. Slope piping and arrange systems to drain at low points.
- K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- L. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- M. Install valves in accordance with Section 15404.
- N. Install pipe identification in accordance with Section 15410.

#### 3.05 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

- A. Install domestic water piping system in accordance with ASME B31.9.



3.06 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

- A. Install sanitary waste and vent piping systems in accordance with ASME B31.9.

3.07 FIELD QUALITY CONTROL

- A. Section **01700 - Execution and Closeout Requirements**: Field inspecting, testing, adjusting, and balancing.
- B. Test domestic water piping system in accordance with **local authority having jurisdiction**.
- C. Test sanitary waste and vent piping system in accordance with **local authority having jurisdiction**.

3.08 CLEANING

- A. Section 01700 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean and disinfect domestic water distribution system in accordance with Section 15430.

END OF SECTION 15425

## SECTION 15430

### FACILITY WATER DISTRIBUTION

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Water Pressure Reducing Valves.
2. Unions and flanges.
3. Pressure gages.
4. Pressure gage taps.
5. Thermometers.
6. Strainers.
7. Water hammer arrestors.
8. Thermostatic mixing valves.

###### B. Related Sections:

1. Section 15425 - Plumbing Piping: Product and installation requirements for piping materials applying to various system types.

##### 1.02 REFERENCES

###### A. American Society of Sanitary Engineering:

1. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
2. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
3. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
4. ASSE 5013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).
5. ASSE 5015 - Performance Requirements for Testing Double Check Backflow Prevention Assemblies (DC) and Double Check Fire Protection Backflow Prevention Assemblies (RPDF).

###### B. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

###### C. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
5. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
6. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
7. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
8. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
9. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
10. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

#### 1.03 SUBMITTALS

- A. Product Data:
  1. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
- B. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.04 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of valves and equipment.
- C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

#### 1.05 QUALITY ASSURANCE

- A. For drinking water service, provide valves complying with NSF 61.
- B. Maintain one copy of each document on site.

#### 1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years **documented** experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years **documented** experience.

1.07 PRE-INSTALLATION MEETINGS

- A. Convene minimum **one** week prior to commencing Work of this Section.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Section 01700 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish **five** year manufacturer warranty for domestic water piping.

1.12 EXTRA MATERIALS

- A. Section 01700 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.01 WATER PRESSURE REDUCING VALVES

- A. Manufacturers:
  - 1. Zurn
  - 2. Substitutions: Approved Equal.

- B. 2 inches and Smaller: MSS SP 80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, double union ends.
- C. 2 inches and Larger: MSS SP 85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

## 2.02 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
  - 1. Ferrous Piping: Class 150, malleable iron, threaded.
  - 2. Copper Piping: Class 150, bronze unions with soldered.
  - 3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
  - 4. PVC Piping: PVC.
  - 5. CPVC Piping: CPVC.
- B. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe

## 2.03 PRESSURE GAGES

- A. Gage: ASME B40.1, UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
  - 1. Case: Stainless steel.
  - 2. Bourdon Tube: Brass.
  - 3. Dial Size: 2 inch diameter.
  - 4. Mid-Scale Accuracy: two percent.
  - 5. Scale: Psi

## 2.04 PRESSURE GAGE TAPS

- A. Needle Valve: Steel, 1/4-inch NPT for minimum 300 psi.
- B. Ball Valve: Stainless Steel, 1/4-inch NPT for 250 psi.
- C. Pulsation Damper: Pressure snubber, brass with 1/4-inch NPT connections.

## 2.05 STEM TYPE THERMOMETERS

- A. Thermometer: ASTM E1, red appearing mercury, lens front tube, cast aluminum case with enamel finish.
  - 1. Size: 7-inch scale.
  - 2. Window: Clear glass.
  - 3. Stem: Brass, 3/4-inch NPT, 3-1/2 inch long.
  - 4. Accuracy: ASTM E77 2 percent.
  - 5. Calibration: Degrees F.

## 2.06 STRAINERS

- A. 2 inch and Smaller: Threaded brass body for 175 psi CWP Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32-inch stainless steel perforated screen.
- B. 1-1/2 inch to 4 inches: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.
- C. 5 inch and Larger: Class 125, flanged iron body, basket pattern with 1/8-inch stainless steel perforated screen.

## 2.07 WATER HAMMER ARRESTORS

- A. ASSE 1010; copper construction, bellows or piston type sized in accordance with PDI WH-201.
- B. Pre-charged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

## 2.08 THERMOSTATIC MIXING VALVES

- A. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment. Conform to ASSE 1070 to temper water to maximum 110 degrees F.
- B. Accessories:
  - 1. Check valve on inlets.
  - 2. Volume control shut-off valve on outlet.
  - 3. Stem thermometer on outlet.
  - 4. Strainers stop checks on inlets.
- C. Cabinet: 16 gage prime coated stainless steel, for surface mounting with keyed lock.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify installation site is ready for installation.

### 3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.

### 3.03 INSTALLATION - ABOVE GROUND PIPING

- A. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- D. Group piping whenever practical at common elevations.
- E. Slope piping and arrange systems to drain at low points.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 099000.
- I. Install domestic water piping in accordance with ASME B31.9.
- J. Sleeve pipes passing through partitions, walls and floors.
- K. Install unions downstream of valves and at equipment or apparatus connections.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- N. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

- O. Test backflow preventers in accordance with ASSE 5013.

#### 3.04 FIELD QUALITY CONTROL

- A. Section 01700 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test domestic water piping system in accordance with **local authority having jurisdiction**.

#### 3.05 CLEANING

- A. Section 01700 - Execution and Closeout Requirements: Requirements for cleaning.

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

- B. Prior to starting work, verify system is complete, flushed and clean.
- C. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
- D. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from **10** percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION 15430



SECTION 15440  
FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Unions and flanges.
2. Floor drains.
3. Cleanouts.
4. Bedding and cover materials.

B. Related Sections:

1. Section 03300 - Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
2. Section 15406 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
3. Section 15410 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
4. Section 02055 - Soils for Earthwork: Soils for backfill in trenches.
5. Section 02060 - Aggregates for Earthwork: Aggregate for backfill in trenches.
6. Section 02315 - Excavation: Product and execution requirements for excavation and backfill required by this section.
7. Section 02315 - Trenching: Execution requirements for trenching required by this section.
8. Section 02315 - Fill: Requirements for backfill to be placed by this section.
9. Section 02630 - Storm Utility Drainage Piping: Catch basins and manholes.

1.02 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A112.21.1 - Floor Drains.

B. ASTM International:

1. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
2. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
3. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

4. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
5. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
6. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
7. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
8. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
9. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

#### 1.03 SUBMITTALS

- A. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors, and manholes.
- B. Product Data:
  1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
  2. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.04 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of piping and clean-outs.

#### 1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with **State** of Florida's standards.
- B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years **documented** experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETINGS

- A. Convene minimum **one** week prior to commencing work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Section 01700 - Execution and Closeout Requirements: Product warranties and product bonds.

1.12 EXTRA MATERIALS

- A. Section 01700 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.01 UNIONS AND FLANGES

- A. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

## 2.02 FLOOR DRAINS

### A. Manufacturers:

1. Zurn

### B. Substitutions: Approved Equal.

- C. Floor Drain (FD-1): ASME A112.21.1; galvanized cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
- D. Floor Drain (FD-2): ASME A112.21.1; galvanized cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable round nickel-bronze strainer with removable perforated sediment bucket.
- E. Floor Drain (FD-3): ASME A112.21.1; galvanized cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer with polished bronze funnel or anti-splash rim.

## 2.03 CLEANOUTS

### A. Manufacturers:

1. Zurn

### B. Substitutions: Approved Equal.

- C. Exterior Surfaced Areas (CO-1): Round cast nickel bronze access frame and non-skid cover.
- D. Exterior Unsurfaced Areas (CO-2): Line type with lacquered cast iron body and round epoxy coated cover with gasket.
- E. Interior Finished Floor Areas (CO-3): Galvanized cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.
- F. Interior Finished Wall Areas (CO-4): Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.
- G. Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

## 2.04 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type [A1] [A2] [A3] [A4] as specified in Section [02060] <\_\_\_\_\_>.

- B. Cover: Fill Type [A1] [A2] [A3] [A4], as specified in Section [02060] <\_\_\_\_\_>.

- C. Soil Backfill from Above Pipe to Finish Grade: Soil Type [S1] [S2], as specified in Section [02055] <\_\_\_\_\_>. [Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.]

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

#### 3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

#### 3.03 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection size, location, and invert are as indicated on Drawings.
- B. Establish elevations of buried piping with not less than   1   ft of cover.
- C. Establish minimum separation of from other services piping in accordance with    latest building code and Area Having Jurisdiction    code.
- D. Remove scale and dirt on inside of piping before assembly.
- E. Install pipe to elevation as indicated on Drawings.
- F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
- G. Install pipe on prepared bedding.
- H. Route pipe in straight line.
- I. Install plastic ribbon tape continuous over top of pipe. buried 6 inches below finish grade, above pipe line;

- J. Install Work in accordance with [State] [Municipality] of < \_\_\_\_\_ > [Highways] [Public Work's] standards.

#### 3.04 INSTALLATION - ABOVE GROUND PIPING

- A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- G. Install piping to maintain headroom. Do not spread piping, conserve space.
- H. Group piping whenever practical at common elevations.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 15420.
- J. Provide access where valves and fittings are not accessible.
- K. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- M. Install bell and spigot pipe with bell end upstream.
- N. Sleeve pipes passing through partitions, walls and floors.

#### 3.05 FIELD QUALITY CONTROL

- A. Section 01700 - Execution and Closeout Requirements]: Field inspecting, testing, adjusting, and balancing.
- B. Test sanitary waste and vent piping system in accordance with local authority having jurisdiction.

3.06 SCHEDULES

A. Pipe Hanger Spacing:

1. Pipe Material: PVC.
  - a. Maximum Hanger Spacing: 4 feet
  - b. 3/8 inch

END OF SECTION

## SECTION 15472

### ELECTRIC DOMESTIC WATER HEATERS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Electric water heaters.
- B. Related Sections:

##### 1.02 REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  - 1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. American Society of Mechanical Engineers:
  - 1. ASME PTC 25 - Pressure Relief Devices.
  - 2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

##### 1.03 SUBMITTALS

- A. Section 01300 – Contractor Submittals: Submittal procedures.
- B. Shop Drawings: Indicate heat exchanger dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.
- C. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.
- D. Manufacturer's Installation Instructions: Submit mounting and support requirements.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

##### 1.04 CLOSEOUT SUBMITTALS

- A. Section 01700 – Contract Closeout: Closeout procedures.
- B. Operation and Maintenance Data: Submit replacement part numbers and availability.



1.05 QUALITY ASSURANCE

- A. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.07 PRE-INSTALLATION MEETINGS

- A. Section 01200 – Project Meetings: Pre-installation meeting.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 – Products, Materials Equipment and Substitutions: Products storage and handling requirements.
- B. Accept water heaters on Site in original labeled cartons. Inspect for damage.
- C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Section 01700 – Contract Closeout: Product warranties and product bonds.
- B. Furnish five-year manufacturer warranty for domestic water heaters.

PART 2 - PRODUCTS

2.01 ELECTRIC WATER HEATERS

- A. Manufacturers:
  - 1. Bradford White
  - 2. Lochinvar
  - 3. AO Smith

- 4. Substitutions: Approved Equal.
- B. Type: Automatic, electric, vertical storage.
- C. Capacity: Refer to Schedule
- D. Tank: Glass lined welded steel, thermally insulated with 1-inch-thick glass fiber; encased in corrosion-resistant steel jacket with baked-on enamel finish.
- E. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls, and electrical junction box.
- F. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME temperature and pressure relief valve.

## 2.02 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics: According to Section 16050 and as shown on the drawings.
- B. Disconnect Switch: Factory mount disconnect switch in on equipment.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Maintain manufacturer's recommended clearances around and over water heaters.
- B. Install water heater on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than water heater base on each side. Refer to Section 03310.
- C. Connect domestic hot and cold-water piping to supply and return water heater connections.
- D. Install the following piping accessories.
  - 1. On Supply:
    - a. Thermometer well and thermometer.
    - b. Strainer.
    - c. Pressure gage.
    - d. Shutoff valve.
  - 2. On Return:
    - a. Thermometer well and thermometer.

- b. Pressure gage.
  - c. Shutoff valve.
- E. Install discharge piping from relief valves and drain valves to nearest floor drain.
- F. Install water heater trim and accessories furnished loose for field mounting.
- G. Install electrical devices furnished loose for field mounting.
- H. Install control wiring between water heater control panel and field mounted control devices.

END OF SECTION

## SECTION 15505

### COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section includes single- and three-phase motors for application on equipment provided under other sections and for motors furnished loose to Project.
- B. Related Sections:
  - 1. Section 16450 - Grounding.

##### 1.02 REFERENCES

- A. American Bearing Manufacturers Association:
  - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. National Electrical Manufacturers Association:
  - 1. NEMA MG 1 - Motors and Generators.
- C. International Electrical Testing Association:
  - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

##### 1.03 SUBMITTALS

- A. Section 01340 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.
- C. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

##### 1.04 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

- B. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Materials and Equipment: Product storage and handling requirements.
- B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.
- C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.
- D. For extended outdoor storage, remove motors from equipment and store separately.

### PART 2 - PRODUCTS

#### 2.01 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

- A. Motors 3/4 hp and Larger: Three-phase motor as specified below.
- B. Motors Smaller Than 3/4 hp: Single-phase motor as specified below, except motors less than 250 watts or 1/4 hp may be equipment manufacturer's standard.
- C. Three-Phase Motors: NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.
  - 1. Voltage: As indicated on Drawings.
  - 2. Service Factor: As indicated on Drawings.
  - 3. Enclosure: Meet conditions of installation unless specific enclosure is indicated on Drawings.
  - 4. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
  - 5. Insulation System: NEMA Class F.
  - 6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

7. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
  8. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
  9. Sound Power Levels: Conform to NEMA MG 1.
- D. Single Phase Motors:
1. Permanent split-capacitor type where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
  2. Voltage: As indicated on drawings volts, single phase, 60 Hz.
- E. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

## 2.02 SOURCE QUALITY CONTROL

- A. Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

## PART 3 - EXECUTION

### 3.01 EXISTING WORK

- A. Disconnect and remove abandoned motors
- B. Maintain access to existing motors and other installations remaining active and requiring access. Modify installation or provide access panel.
- C. Clean and repair existing motors to remain or are to be reinstalled.

### 3.02 INSTALLATION

- A. Install securely on firm foundation. Mount ball bearing motors in accordance with motor manufacturer's requirements.

### 3.03 FIELD QUALITY CONTROL

- A. Section 01700 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.

- C. Perform inspections and tests listed in NETA ATS, Section 7.15.

END OF SECTION



## SECTION 15520

### HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes:
  - 1. Pipe hangers and supports.
  - 2. Hanger rods.
  - 3. Inserts.
  - 4. Sleeves.
  - 5. Mechanical sleeve seals.
  - 6. Formed steel channel.
  - 7. Equipment bases and supports.

##### 1.02 REFERENCE STANDARDS

- A. American Welding Society:
  - 1. AWS D1.1- Structural Welding Code - Steel.
- B. ASME International:
  - 1. ASME B31.1 - Power Piping.
  - 2. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.
  - 3. ASME B31.9 - Building Services Piping.
- C. ASTM International:
  - 1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
  - 2. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
  - 3. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
  - 4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
- D. FM Global:
  - 1. FM - Approval Guide.
- E. Intertek Testing Services (Warnock Hersey Mark):

1. WH-ETL - Product Directory.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

G. UL:

1. UL - Fire-resistance-rated Systems and Products.
2. UL 263 - Fire Tests of Building Construction and Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

1.03 PREINSTALLATION MEETINGS

- A. Section 01300 - Administrative Requirements: Requirements for preinstallation meeting.
- B. Convene minimum one week prior to commencing Work of this Section.

1.04 SUBMITTALS

- A. Section 01330 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
  1. Hangers and Supports: Submit manufacturer's catalog information, including load capacity.
  2. Firestopping: Submit information on product characteristics, performance, and limitations.
- C. Shop Drawings:
  1. Indicate system layout with location, including critical dimensions and sizes.
  2. Indicate pipe hanger and support locations, and detail of trapeze hangers.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrated items, and specified design numbers to seal openings to maintain fire-resistance rating of adjacent assembly.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Delegated Design Submittals:

1. Submit signed and sealed Shop Drawings with design calculations and assumptions for load-carrying capacity of trapeze, multiple-pipe, and riser support hangers.
2. Submit sizing methods and calculations sealed by a registered professional engineer (P.E.).
3. Firestopping Engineering Judgments: For conditions not covered by UL or WH-ETL listed designs, submit judgments by licensed P.E. suitable for presentation to authority having jurisdiction for acceptance as meeting fire protection code requirements.

G. Manufacturer Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

I. Qualifications Statements:

1. Submit qualifications for manufacturer, installer, and licensed professional.
2. Submit manufacturer's approval of installer.
3. Welders: Qualify procedures and personnel according to AWS D1.1/D1.1M.

1.05 QUALITY ASSURANCE

- A. Welding of Hanger and Support Attachments to Building Structure: Comply with AWS D1.1.
- B. Maintain one copy of each standard affecting Work of this Section on Site.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this Section with three years documented experience and approved by manufacturer.
- C. Welders: AWS qualified within previous 12 months for employed weld types.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

- C. Store materials according to manufacturer instructions.
- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.

#### 1.08 AMBIENT CONDITIONS

- A. Minimum Conditions:
  - 1. Do not apply firestopping materials if temperature of substrate material and ambient air is below 60 degrees F.
  - 2. Maintain this minimum temperature before, during, and for minimum three days after installation of firestopping materials.
- B. Provide ventilation in areas to receive solvent cured materials.

#### 1.09 EXISTING CONDITIONS

- A. Field Measurements:
  - 1. Verify field measurements prior to fabrication.
  - 2. Indicate field measurements on Shop Drawings.

#### 1.10 WARRANTY

- A. Section 01700 – Contract Closeout: Requirements for warranties.
- B. Furnish five-year manufacturer's warranty for pipe hangers and supports.

### PART 2 - PRODUCTS

#### 2.01 PIPE HANGERS AND SUPPORTS

- A. Refrigerant Piping:
  - 1. Conform to ASME B31.5.
  - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2: 316 Stainless Steel adjustable swivel, split ring.
  - 3. Hangers for Pipe Sizes 2 Inches and Larger: 316 Stainless Steel, adjustable, clevis.
  - 4. Vertical Support: 316 Stainless Steel riser clamp.

5. Floor Support: 316 Stainless Steel adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
6. Copper Pipe Support: Copper-plated carbon-steel ring.

B. Accessories:

1. Hanger Rods: Mild steel threaded both ends

## 2.02 INSERTS

A. Description:

1. Malleable iron case with 316 Stainless steel shell and expander plug for threaded connection.
2. Lateral adjustment, top slot for reinforcing rods, and lugs for attaching to forms.
3. Size: To suit threaded hanger rods.

## 2.03 SLEEVES

A. Pipes through Non-fire-rated Floors:

1. Material: 316 Stainless steel.
2. Thickness: 18 gauge.

B. Pipes through Non-fire-rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18-gauge galvanized steel.

C. Round Ductwork: Galvanized steel.

D. Rectangular Ductwork: Galvanized steel or wood.

E. Sealant:

1. Material: Acrylic.

## 2.04 MECHANICAL SLEEVE SEALS

A. Description:

1. Type: Modular mechanical.
2. Configuration: Interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve.
3. Connection: Bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and insulation.

## 2.05 FORMED STEEL CHANNEL

### A. Description:

1. Material: Galvanized 12-gage steel.
2. Thickness: 12 gage.
3. Hole Spacing: 1-1/2 inches o.c.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Section 01700 - Contract Closeout Requirements: Requirements for installation examination.
- B. Verify that openings are ready to receive sleeves.
- C. Verify that openings are ready to receive firestopping.

### 3.02 PREPARATION

- A. Section 01700 - Contract Closeout Requirements: Requirements for installation preparation.
- B. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that may affect bond of firestopping material.
- C. Remove incompatible materials that may affect bond.
- D. Obtain permission from architect/engineer before using powder-actuated anchors.
- E. Do not drill or cut structural members.
- F. Obtain permission from architect/engineer before drilling or cutting structural members.

### 3.03 INSTALLATION

#### A. Inserts:

1. Install inserts for placement in concrete forms.
2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
4. If concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. If inserts are omitted, drill through concrete slab from below and provide through bolt with recessed square steel plate and nut flush with top of slab.
- B. Pipe Hangers and Supports:
1. Comply with ASME B31.1 Support horizontal piping as scheduled
  2. Minimum Hanger Spacing: 1/2 inch between finished covering and adjacent Work.
  3. Place hangers within 12 inches of each horizontal elbow.
  4. Minimum Vertical Hanger Adjustment: 1-1/2 inches.
  5. If piping is installed in parallel and at same elevation, provide multiple-pipe or trapeze hangers.
  6. Support riser piping independently of connected horizontal piping.
  7. Provide copper-plated hangers and supports for copper piping.
  8. Design hangers for pipe movement without disengagement of supported pipe.
  9. Painting and Coating:
    - a. Prime coat exposed steel hangers and supports.
    - b. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Insulation:
- a. Provide clearance in hangers and from structure and other equipment for installation of insulation.
- C. Equipment Bases and Supports:
1. Provide housekeeping pads of concrete as specified in Section 03300 - Cast-in-Place Concrete.
  2. Minimum Size: 3-1/2 inches thick and extending 6 inches beyond supported equipment.
  3. Use templates furnished with equipment to install equipment anchor bolts and accessories.
  4. Supports:
    - a. Material: Formed steel channel.
    - b. Brace and fasten with flanges bolted to structure.
- D. Sleeves:
1. Exterior Watertight Entries: Seal with mechanical sleeve seals.
  2. Set sleeves in position in forms and provide reinforcing around sleeves.
  3. Sizing:
    - a. Size sleeves large enough to allow for movement due to expansion and contraction.
    - b. Provide for continuous insulation wrapping.
  4. 4. Extend sleeves through floors 1 inch above finished floor level, and calk sleeves.

5. Spaces:

- a. If piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent Work with stuffing insulation and calk airtight.
- b. Provide close-fitting metal collar or escutcheon covers at both sides of penetration.
- c. Install stainless-steel escutcheons at finished surfaces.

3.04 FIELD QUALITY CONTROL

- A. Section 01700 - Contract Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.05 CLEANING

- A. Section 01700 - Contract Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Section 01700 - Contract Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.07 ATTACHMENTS

- A. Pipe Hanger Spacing:
  - 1. Pipe Material: Copper tube.
    - a. Size: 1-1/4 inches1-1/4 inches and smaller.
    - b. Maximum Hanger Spacing: 6 feet6 feet.
    - c. Hanger Rod Diameter: 1/2 inch1/2 inch.
  - 2. Pipe Material: Copper tube.
    - a. Size: 1-1/2 inches1-1/2 inches and larger.
    - b. Maximum Hanger Spacing: 10 feet10 feet.
    - c. Hanger Rod Diameter: 1/2 inch1/2 inch.



3. Pipe Material: PVC.
  - a. Maximum Hanger Spacing: 4 feet4 feet.
  - b. Hanger Rod Diameter: 3/8 inch3/8 inch.

END OF SECTION

## SECTION 15530

### IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Nameplates.
2. Tags.
3. Pipe markers.
4. Labels.

##### 1.02 REFERENCES

###### A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

##### 1.03 SUBMITTALS

- A. Product Data: Submit manufacturers catalog literature for each product required.
- B. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

##### 1.04 CLOSEOUT SUBMITTALS

- A. Section 01700 - Contract Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.05 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.
- B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience

1.07 PRE-INSTALLATION MEETINGS

- A. Section 01200 – Project Meetings: Pre-installation meeting.

1.08 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.09 EXTRA MATERIALS

- A. Section 01700 - Contract Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.01 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved blackletters on light contrasting background color.

2.02 TAGS

- A. Metal Tags
  - a. Stainless Steel with stamped letters; tag size minimum 1-1/2 inches square with finished edges.
- B. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame

## 2.03 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers
  - 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Pipe Markers

2.04 Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

## 2.05 LABELS.

- A. Description: Aluminum, size 1.9 x 0.75 inches1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

### 3.02 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- C. Install tags using corrosion resistant chain. Number tags consecutively by location.

### 3.03 SCHEDULES

- A. Identification:
  - 1. Refrigerant Piping.
    - a. Identification Type: Pipe Marker
    - b. Background Color: Yellow

- c. Lettering Color: Black
- 2. Condensate Piping.
  - a. Identification Type: Pipe Marker
  - b. Background Color: Green
  - c. Lettering Color: White
- 3. Ductwork.
  - a. Identification Type: Blue
  - b. Lettering Color: White

END OF SECTION

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## SECTION 15540

### HVAC INSULATION

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. HVAC piping insulation, jackets, and accessories.
2. HVAC ductwork insulation, jackets, and accessories.

##### 1.02 REFERENCES

###### A. ASTM International:

1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
5. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
6. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
7. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
8. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
9. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
10. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

11. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  12. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
  13. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
  14. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  15. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  16. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  17. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
  18. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
  19. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
  20. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
  21. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
  22. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
  23. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- B. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- C. Underwriters Laboratories Inc.:
1. UL 1978 - Standard for Safety for Grease Ducts.



### 1.03 SUBMITTALS

- A. Section 01300 – Contractor Submittals: Submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### 1.04 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Duct insulation, Coverings, and Linings: Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E 2231.

### 1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

### 1.06 PRE-INSTALLATION MEETINGS

- A. Section 01200 – Project Meetings: Pre-installation meeting.

### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 – Products, Material Equipment and Substitutions: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

## 1.08 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 – Products, Materials Equipment and Substitutions: Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

## 1.09 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

## 1.10 WARRANTY

- A. warranties and product bonds.
- B. Furnish five-year manufacturer warranty for manmade fiber.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURER

- A. Glass Fiber and Mineral Fiber Insulation
  - 1. Manufacturers:
    - a. Knauf
    - b. Owens Corning
    - c. Johns Manville
    - d. Substitutions: Section 01600 - Product Requirements.
- B. Closed Cell Elastomeric Insulation
  - a. Knauf
  - b. Owens Corning
  - c. Johns Manville
  - d. Substitutions: Section 01600 - Product Requirements.

## 2.02 PIPE INSULATION

A. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.

1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

## 2.03 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:

1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Water Vapor Permeance: ASTM E96; 0.02 perms.

B. Aluminum Pipe Jacket:

1. ASTM B209.
2. Thickness: 0.016-inch-thick sheet.
3. Finish: Smooth.
4. Joining: Longitudinal slip joints and 2-inch laps.
5. Fittings: 0.016-inch-thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015-inch-thick aluminum. 0.010-inch-thick stainless steel.

## 2.04 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.
- E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum single piece construction with self-adhesive closure. Thickness to match pipe insulation.
- F. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.

- G. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.
- H. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- I. Adhesives: Compatible with insulation.

## 2.05EQUIPMENT INSULATION

- A. TYPE E-7: ASTM C533; Type II, hydrous calcium silicate block insulation, asbestos free.
  - 1. Thermal Conductivity: 0.45 at 200 degrees F.
  - 2. Operating Temperature Range: 140 to 1200 degrees F.

## 2.06DUCTWORK INSULATION

- A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
  - 1. Thermal Conductivity: 0.27 at 75 degrees F.
  - 2. Maximum Operating Temperature: 250 degrees F.
  - 3. Density: 1.0 pound per cubic foot.
- B. TYPE D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied reinforced aluminum foil facing meeting ASTM C1136, Type II.
  - 1. Thermal Conductivity: 0.24 at 75 degrees F.
  - 2. Density: 1.6 pound per cubic foot.
- C. TYPE D-4: ASTM C1071, Type I, flexible, glass fiber duct liner with coated air side.
  - 1. Thermal Conductivity: 0.28 at 75 degrees F.
  - 2. Density: 1.5 pound per cubic foot.
  - 3. Maximum Operating Temperature: 250 degrees F.
  - 4. Maximum Air Velocity: 6,000 feet per minute.
- D. TYPE D-5: ASTM C1071, Type II, rigid, glass fiber duct liner with coated air side.
  - 1. Thermal Conductivity: 0.23 at 75 degrees F.
  - 2. Density: 3.0 pound per cubic foot.

3. Maximum Operating Temperature: 250 degrees F.
  4. Maximum Air Velocity: 4,000 feet per minute.
- E. TYPE D-6: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet.
1. Thermal Conductivity: 0.27 at 75 degrees F.
  2. Service Temperature Range: Range: Minus 58 to 180 degrees F.
- F. TYPE D-7: ASTM C534, Type II, flexible, closed cell elastomeric insulation, sheet laminated with white thermoplastic rubber membrane.
1. Thermal Conductivity: 0.27 at 75 degrees F.
  2. Service Temperature Range: Range: Minus 58 to 180 degrees F.

## 2.07 DUCTWORK INSULATION JACKETS

- A. Aluminum Duct Jacket:
1. ASTM B209.
  2. Thickness: 0.016-inch-thick sheet.
  3. Finish: Smooth.
  4. Joining: Longitudinal slip joints and 2-inch laps.
  5. Fittings: 0.016-inch-thick die shaped fitting covers with factory attached protective liner.
  6. Metal Jacket Bands: 3/8 inch wide; 0.015-inch-thick aluminum. 0.010-inch-thick stainless steel.
- B. Vapor Retarder Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  2. Water Vapor Permeance: ASTM E96; 0.02 perms.
  3. Secure with pressure sensitive tape.
- C. Canvas Duct Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.
- D. Outdoor Duct Jacket: Asphalt impregnated and coated sheet, 50 lb./square.

- E. Membrane Duct Jacket: ASTM D4637; Type I, EPDM; non-reinforced, 0.045 inch thick, 48-inch-wide roll; white color as selected.

## 2.08 DUCTWORK INSULATION ACCESSORIES

- A. Vapor Retarder Tape:
  - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.
- B. Vapor Retarder Lap Adhesive: Compatible with insulation.
- C. Adhesive: Waterproof, ASTM E162 fire-retardant type.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.
- E. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers.
- F. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- H. Adhesives: Compatible with insulation.
- I. Membrane Adhesives: As recommended by membrane manufacturer.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Section 01100 – Special Project procedures: Coordination and project conditions.
- B. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

### 3.02 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.

C. Piping Systems Conveying Fluids Below Ambient Temperature:

1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Glass Fiber Board Insulation:

1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

E. Inserts and Shields:

1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
  - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
  - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

F. Closed Cell Elastomeric Insulation:

1. Push insulation on to piping.
2. Miter joints at elbows.

3. Seal seams and butt joints with manufacturers recommended adhesive.
  4. When application requires multiple layers, apply with joints staggered.
  5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with aluminum jacket or stainless-steel jacket.
- H. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum or stainless-steel jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.
- I. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.
- J. Prepare pipe insulation for finish painting. Refer to Section 09900.

### 3.03 INSTALLATION - EQUIPMENT

- A. Factory Insulated Equipment: Do not insulate.
- B. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- D. Equipment Containing Fluids Below Ambient Temperature:
1. Insulate entire equipment surfaces.
  2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
  3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
  4. Finish insulation at supports, protrusions, and interruptions.



- E. Equipment Containing Fluids 140 degrees F or Less:
  - 1. Do not insulate flanges and unions, but bevel and seal end of insulation.
  - 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
  - 3. Finish insulation at supports, protrusions, and interruptions.
- F. Equipment Containing Fluids Over 140 degrees F:
  - 1. Insulate flanges and unions with removable sections and jackets.
  - 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
  - 3. Finish insulation at supports, protrusions, and interruptions.
- G. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with aluminum jacket or stainless-steel jacket.
- H. Equipment Located Exterior to Building: Install vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum or stainless-steel jacket with seams located on bottom side of horizontal equipment.
- I. Cover glass fiber cellular glass hydrous calcium silicate cellular foam insulation with aluminum jacket or stainless-steel jacket.
- J. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
- K. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- L. Prepare equipment insulation for finish painting. Refer to Section 09900.

### 3.04 INSTALLATION - DUCTWORK SYSTEMS

- A. Duct dimensions indicated on Drawings are finished inside dimensions.
- B. Insulated ductwork conveying air below ambient temperature:
  - 1. Provide insulation with vapor retarder jackets.
  - 2. Finish with tape and vapor retarder jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
1. Provide with or without standard vapor retarder jacket.
  2. Insulate fittings and joints. Where service access is required, bevel and seal end of insulation.
- D. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with aluminum jacket.
- E. External Glass Fiber Duct Insulation:
1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
  2. Secure insulation without vapor retarder with staples, tape, or wires.
  3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
  4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
  5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- F. External Elastomeric Duct Insulation:
1. Adhere to clean oil-free surfaces with full coverage of adhesive.
  2. Seal seams and butt joints with manufacturers recommended adhesive.
  3. When application requires multiple layers, apply with joints staggered.
  4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
  5. Lift ductwork off trapeze hangers and insert spacers.
- G. Duct Liner:
1. Adhere insulation with adhesive for 100 percent coverage.

2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
  3. Seal and smooth joints. Seal and coat transverse joints.
  4. Seal liner surface penetrations with adhesive.
  5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.
- H. Kitchen Exhaust Ductwork:
1. Cover duct by wrapping with insulation using overlap method.
  2. Overlap seams of each method by 3 inches.
  3. Attach insulation using steel banding or by welded pins and clips.
  4. Install insulation without sag on underside of ductwork. Use additional fasteners to prevent sagging.
- I. Prepare duct insulation for finish painting. Refer to Section 099000.

### 3.05 SCHEDULES

1. Refrigerant Suction:
    - a. Type: P-5.
    - b. Thickness: 0.5 inch
  2. Refrigerant Hot Gas:
    - a. Type: P-5.
    - b. Thickness: 0.5 inch
  3. Condensate Piping from Cooling Coils:
    - a. Type: P-5.
    - b. Thickness: 0.5 inch
- A. Ductwork Insulation Schedule:
1. Outside Air Intake:
    - a. Type: D-2.

- b. Thickness: 1.5 inch
- 2. Exhaust Ducts Within 10 feet of Exterior Openings, Installed Thickness:
  - a. Type: D-1 or D-2.
  - b. Thickness: 1.0 inches.

END OF SECTION

SECTION 15575  
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Refrigerant piping.
2. Unions, flanges, and couplings.
3. Refrigerant moisture and liquid indicators.
4. Valves.

B. Related Sections:

1. Section 09900 - Painting and Coating: Product requirements for painting for placement by this section.
2. Section 15520 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports, sleeves, for placement by this section.
3. Section 15530 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.
4. Section 15540 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.

1.02 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. ARI 495 - Refrigerant Liquid Receivers.
2. ARI 710 - Liquid-Line Driers.
3. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.
4. ARI 750 - Thermostatic Refrigerant Expansion Valves.

5. ARI 760 - Solenoid Valves for Use with Volatile Refrigerants.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
  1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. American Society of Mechanical Engineers:
  1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
  3. ASME B31.5 - Refrigeration Piping.
  4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- D. ASTM International:
  1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  2. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
  3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
  4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
  5. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
  6. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- E. American Welding Society:
  1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
  2. AWS D1.1 - Structural Welding Code - Steel.
- F. Manufacturers Standardization Society of the Valve and Fittings Industry:
  1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
  2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
  3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

- G. Underwriters Laboratories Inc.:
  - 1. UL 429 - Electrically Operated Valves.

#### 1.03 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.
- B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.
- C. Provide pipe hangers and supports in accordance with ASME B31.5,.
- D. Provide receivers sized to accommodate pump down charge.
- E. Flexible Connectors: Use at or near compressors where piping configuration does not absorb vibration.

#### 1.04 SUBMITTALS

- A. Section 01340 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.
- C. Product Data:
  - 1. Piping: Submit data on pipe materials, fittings, and accessories.
  - 2. Valves: Submit manufacturer's catalog information with valve data and ratings for each service.
  - 3. Hangers and Supports: Submit manufacturer's catalog information including load capacity.
  - 4. Refrigerant Specialties: Submit manufacturer's catalog information including capacity, component sizes, rough-in requirements, and service sizes for the following:
    - a. Refrigerant moisture and liquid indicators.
    - b. Refrigerant strainers.
    - c. Refrigerant pressure regulators.

- d. Refrigerant pressure relief valves.
  - e. Refrigerant filter-driers.
  - f. Refrigerant solenoid valves.
  - g. Refrigerant expansion valves.
  - h. Electronic expansion valves.
- D. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Test Reports: Indicate results of refrigerant leak test.
- F. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.
- G. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- H. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of valves, equipment and refrigerant accessories.
- C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

#### 1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.5 code for installation of refrigerant piping systems.
- B. Maintain one copy of each document on site.

#### 1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' documented experience.
- B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years' documented experience approved by manufacturer.



- C. Design hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Florida.

#### 1.08 PRE-INSTALLATION MEETINGS

- A. Section 01200 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Materials and Equipment: Product storage and handling requirements.
- B. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.
- C. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

#### 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 - Materials and Equipment.
- B. Do not install underground piping when bedding is wet or frozen.

#### 1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

#### 1.12 WARRANTY

- A. Section 01700 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five-year manufacturer's warranty for valves excluding packing.

#### 1.13 MAINTENANCE MATERIALS

- A. Section 01700 - Execution and Closeout Requirements: Spare parts and maintenance products.

#### 1.14 EXTRA MATERIALS

- A. Section 01700 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two packing kits for each size and valve type.
- C. Furnish two refrigerant filter-dryer cartridges of each type.

### PART 2 - PRODUCTS

#### 2.01 REFRIGERANT PIPING

- A. Copper Tubing: ASTM B280, drawn.
  - 1. Fittings: ASME B16.22 wrought copper.
  - 2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

#### 2.02 UNIONS, FLANGES, AND COUPLINGS

- A. 2 inches and Smaller:
  - 1. Ferrous Piping: 150 psig malleable iron, threaded.
  - 2. Copper Pipe: Bronze, soldered joints.
- B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- C. Refer to Section 15520.

#### 2.03 REFRIGERANT MOISTURE AND LIQUID INDICATORS

- A. Indicators:
  - 1. Port: Double, UL listed.
  - 2. Body: Copper or brass, flared or solder ends.
  - 3. Sight glass: Color-coded paper moisture indicator with removable element cartridge and plastic cap.
  - 4. Maximum working pressure: 500 psig
  - 5. Maximum working temperature: 200 degrees F.

## 2.04 VALVES

### A. Diaphragm Packless Valves:

1. UL listed, globe or angle pattern, forged brass body and bonnet solder or flared ends.
2. Phosphor bronze and stainless steel diaphragms, rising stem and hand wheel.
3. Stainless steel spring, nylon seats, disc with positive back seating.
4. Maximum working pressure: 500 psig.
5. Maximum working temperature: 275 degrees F.

### B. Packed Angle Valves:

1. Forged brass or nickel-plated forged steel, solder or flared ends.
2. Forged brass seal caps with copper gasket, rising stem and seat with back seating, molded stem packing.
3. Maximum working pressure: 500 psig.
4. Maximum working temperature: 275 degrees F.

### C. Ball Valves:

1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals, soldered or threaded ends.
2. Maximum working pressure: 500 psig.
3. Maximum working temperature: 300 degrees F.

### D. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends.
2. Maximum working pressure: 500 psig.

### E. Refrigerant Check Valves:

1. Globe Type:

- a. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc.
  - b. Maximum working pressure: 425 psig.
  - c. Maximum working temperature: 300 degrees F.
- 2. Straight Through Type:
  - a. Spring, neoprene seat.
  - b. Maximum working pressure: 500 psig.
  - c. Maximum working temperature: 250 degrees F.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

#### 3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

#### 3.03 INSTALLATION - INSERTS

- A. Provide inserts for placement in concrete forms.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

### 3.04 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install pipe hangers and supports in accordance with Section 15520.

### 3.05 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

- A. Route piping parallel to building structure and maintain gradient.
- B. Install piping to conserve building space, and not interfere with use of space.
- C. Group piping whenever practical at common elevations.
- D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 230529.
- E. Install pipe identification in accordance with Section 230553.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide access where valves and fittings are not exposed.
- H. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- I. Flood refrigerant piping system with nitrogen when brazing.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- K. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09900.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Insulate piping and equipment; refer to Section 15540.
- N. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.
- O. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
- P. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.
- Q. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

- R. Provide electrical connection to solenoid valves.
- S. Fully charge completed system with refrigerant after testing.
- T. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
- U. Install refrigerant piping in accordance with ASME B31.5.

### 3.06 INSTALLATION - REFRIGERANT SPECIALTIES

#### A. Refrigerant Liquid Indicators:

1. Install line size liquid indicators in main liquid line downstream of condenser.
2. When receiver is provided, install line size liquid indicators in liquid line downstream of receiver.
3. Install line size liquid indicators downstream of liquid solenoid valves.

#### B. Refrigerant Valves:

1. Install service valves on compressor suction and discharge.
2. Install gage taps at compressor inlet and outlet.
3. Install gage taps at hot gas bypass regulators, inlet and outlet.
4. Install check valves on compressor discharge.
5. Install check valves on condenser liquid lines on multiple condenser systems.
6. Install refrigerant charging valve in liquid line between receiver shut-off valve and expansion valve.

#### C. Strainers:

1. Install line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, install single main liquid-line strainer.
3. On steel piping systems, install strainer in suction line.
4. Install shut-off valves on each side of strainer.

- D. Install pressure relief valves on ASME receivers. Install relief valve discharge piping to terminate outdoors.

### 3.07 FIELD QUALITY CONTROL

- A. Section 01700 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing. Test refrigeration system in accordance with ASME B31.5.
- B. Pressure test refrigeration system with dry nitrogen to 200 psig.
- C. Repair leaks.
- D. Retest until no leaks are detected.

### 3.08 SCHEDULES

- A. Copper Tube Hanger Spacing:
  - 1. Pipe Size 1/2 Inch:
    - a. Maximum Hanger Spacing: 5 feet.
    - b. Hanger Rod Diameter: 3/8 inch.
  - 2. Pipe Size 3/4 Inch:
    - a. Maximum Hanger Spacing: 5 feet.
    - b. Hanger Rod Diameter: 3/8 inch.
  - 3. Pipe Size 1 Inch:
    - a. Maximum Hanger Spacing: 6 feet.
    - b. Hanger Rod Diameter: 3/8 inch.
  - 4. Pipe Size 1-1/4 Inches:
    - a. Maximum Hanger Spacing: 7 feet.
    - b. Hanger Rod Diameter: 3/8 inch

END OF SECTION

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## SECTION 15761

### DUCTLESS SPLIT-SYSTEM AIR-CONDITIONERS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Fan Coil Unit / Evaporator.
  - a. Wall, Ceiling, or Ceiling Cassette
2. Condensing unit.
  - a. For units/systems up to three tons maximum

###### B. Related Sections:

1. Section 03300 - Cast-In-Place Concrete: Execution requirements for concrete foundations specified by this section.
2. Section 15575 - Refrigerant Piping: Execution requirements for connection to refrigerant piping specified by this section.
3. Section 16120 – Wires and Cables: Electrical connection to units.

##### 1.02 REFERENCES

###### A. Air-Conditioning and Refrigeration Institute:

1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
3. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
4. ARI 365 - Commercial and Industrial Unitary Air-Conditioning Condensing Units.

###### B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

###### C. ASTM International:

1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

###### D. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.
- E. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

#### 1.03 SUBMITTALS

- A. Product Data: Submit data indicating:
1. Cooling and heating capacities.
  2. Dimensions.
  3. Weights.
  4. Rough-in connections and connection requirements.
  5. Duct connections.
  6. Electrical requirements with electrical characteristics and connection requirements.
  7. Controls.
  8. Accessories.
- B. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- D. Manufacturer's Field Reports: Submit start-up report for each unit.

#### 1.04 CLOSEOUT SUBMITTALS

- A. Section 01700 – Contract Closeout: Closeout procedures.
- B. Project Record Documents: Record actual locations of controls installed remotely from units.
- C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

#### 1.05 QUALITY ASSURANCE

- A. Performance Requirements: Energy Efficiency Rating (EER) not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils when tested in accordance with ARI 340/360.
- B. Cooling Capacity: Rate in accordance with ARI 340/360 ARI 365.
- C. Sound Rating: Measure in accordance with ARI 270.
- D. Insulation and adhesives: Meet requirements of NFPA 90A.

- E. Maintain one copy of each document on site.

#### 1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' documented experience.

#### 1.07 PRE-INSTALLATION MEETINGS

- A. Section 01200 – Project Meetings: Pre-installation meeting.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 – Material and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
- C. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.
- D. Protect units from weather and construction traffic by storing in dry, roofed location.

#### 1.09 COORDINATION

- A. Coordinate installation of condensing units with building structure.
- B. Coordinate installation of air handling units with building structure.

#### 1.10 WARRANTY

- A. Section 01700 – Contract Closeout: Requirements for warranties.
- B. Furnish five-year manufacturer's warranty for compressors.

#### 1.11 MAINTENANCE SERVICE

- A. Section 01700 – Contract Closeout: Requirements for maintenance service.

- B. Furnish service and maintenance of equipment for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including filter replacements, fan belt replacement, and controls checkout and adjustments.
- C. Furnish 24-hour emergency service on breakdowns and malfunctions for this maintenance period. Furnish capability of response time within 24 hours.

#### 1.12 MAINTENANCE MATERIALS

- A. Section 01700 – Contract Closeout: Requirements for maintenance materials.

### PART 2 - PRODUCTS

#### 2.01 SPLIT SYSTEM AIR CONDITIONING UNITS

- A. Manufacturers:
  - 1. LG
  - 2. Mitsubishi
  - 3. Daikin
  - 4. Substitutions: Section 01600 - Product Requirements.
- B. Product Description: Split system consisting of fan coil unit and condensing unit including cabinet, evaporator fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, air filters, controls, air handling unit accessories, condensing unit accessories, and refrigeration specialties.

#### 2.02 Fan Coil Unit

- A. Configuration: As indicated on Drawings.
- B. Cabinet:
  - 1. Panels: Constructed of galvanized steel with baked enamel finish. Access Panels: Located on both sides of unit. Furnish with duct collars on inlets and outlets.
  - 2. Insulation: Factory applied to each surface to insulate entire cabinet. one inch thick aluminum foil faced glass fiber with edges protected from erosion.
- C. Evaporator Fan: Forward curved centrifugal type, resiliently mounted with adjustable belt drive and high efficiency motor complying with NEMA MG1, Type 1. Motor permanently lubricated with built-in thermal overload protection.

- D. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Factory leak tested under water. Removable, PVC construction, double-sloped drain pan with piping connections on both sides. Coil shall be coated as specified in 15805.
- E. Refrigeration System: Single refrigeration circuits controlled by factory installed thermal expansion valve.
- F. Air Filters: 1 inch thick glass fiber disposable media in metal frames. 25 to 30 percent efficiency based on ASHRAE 52.1.
- G. Unit shall be wall mounted, ceiling mounted, or ceiling cassette type (integral with grid).

## 2.03 CONDENSING UNIT

- A. General: Factory assembled and tested air cooled condensing units, consisting of casing, compressors, condensers, coils, condenser fans and motors, and unit controls.
- B. Unit Casings: Exposed casing surfaces constructed of galvanized steel with manufacturer's standard baked enamel finish or additional coating as specified. Designed for outdoor installation and complete with weather protection for components and controls, and complete with removable panels for required access to compressors, controls, condenser fans, motors, and drives.
- C. Compressor: Single refrigeration circuit with rotary or semi-hermetic reciprocating type compressors, resiliently mounted, with positive lubrication, and internal motor overload protection.
- D. Condenser Coil: Constructed of copper tubing mechanically bonded to copper fins, factory leak and pressure tested.
- E. Controls: Furnish operating and safety controls including high and low pressure cutouts. Control transformer. Furnish magnetic contactors for compressor and condenser fan motors.
- F. Condenser Fans and Drives: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Permanently lubricated ball bearing type motors with built-in thermal overload protection. Furnish high efficiency fan motors.
- G. Condensing Unit Accessories: Furnish the following accessories:
  - 1. Controls to provide low ambient cooling to 0 degrees F.
  - 2. Time delay relay.
  - 3. Anti-short cycle timer.
  - 4. Disconnect switch.
  - 5. Vibration isolators.
  - 6. Hot gas bypass kit.
  - 7. Coil with corrosion resistant coating capable of withstanding salt spray test of 1000 hours in accordance with ASTM B117.

8. Condenser Coil Guard: Condenser fan openings furnished with PVC coated steel wire safety guards.
9. Suction and discharge pressure gauges.

H. Refrigeration specialties: Furnish the following:

1. Charge of compressor oil.
2. Holding charge of refrigerant.
3. Replaceable core type filter drier.
4. Liquid line sight glass and moisture indicator.
5. Shut-off valves on suction and liquid piping.
6. Liquid line solenoid valve.
7. Charging valve.
8. Oil level sight glass.
9. Crankcase heater.
10. Hot gas muffler.
11. Pressure relief device.

2.04 CONTROLS

- A. Thermostat: 7 day programmable electronic space thermostat with single stage heating and single stage cooling with manual changeover and heating setback and cooling setup capability. Furnish system selector switch off-heat-auto-cool and fan control switch, auto-on.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify concrete pad for condensing unit is ready for unit installation.

3.02 INSTALLATION – FAN COIL UNIT

- A. Install condensate piping with trap and route from drain pan to condensate drainage system.
- B. Install components furnished loose for field mounting.
- C. Install connection to electrical power wiring in accordance with Section 16110.

### 3.03 INSTALLATION - CONDENSING UNIT

- A. Install units on wall supports.
- B. Install refrigerant piping from unit to condensing unit. Install refrigerant specialties furnished with unit. Refer to Section 15575.
- C. Evacuate refrigerant piping and install initial charge of refrigerant.
- D. Install electrical devices furnished loose for field mounting.
- E. Install control wiring between air handling unit, condensing unit, and field installed accessories.
- F. Install connection to electrical power wiring in accordance with Section 16110.

### 3.04 MANUFACTURER'S FIELD SERVICES

- A. Section 01650 – Start-Up and Demonstration: Requirements for manufacturer's field services.
- B. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

### 3.05 CLEANING

- A. Section 01710 - Cleaning: Requirements for cleaning.
- B. Vacuum clean coils and inside of unit cabinet.
- C. Install new throwaway filters in units at Substantial Completion.

### 3.06 DEMONSTRATION

- A. Section 01650 – Start-up and Demonstration: Requirements for demonstration and training.
- B. Demonstrate air handling unit operation and maintenance.
- C. Demonstrate starting, maintenance, and operation of condensing unit including low ambient temperature operation.

### 3.07 PROTECTION OF FINISHED WORK

- A. Section 01700 – Contract Closeout: Requirements for protecting finished Work.

END OF SECTION

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SECTION 15805  
COATINGS FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes application of coating systems on internal HVAC components and external equipment surfaces, including the following systems:

- 1. Air-dried corrosion-resistant coating systems.

1.02 DEFINITIONS

- A. Salt Water Acetic Acid Test (SWAAT): A salt fog-spray test of corrosion resistance performed in accordance with ASTM G85, Annex 3.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include Safety Data Sheets, preparation requirements, and application instructions.

1.04 INFORMATIONAL SUBMITTALS

- A. Source Quality-Control Reports:

- 1. Certification of coating material testing.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Coatings: 1 of each material and color applied, including base coat and top coat products.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in clean, dry, well-ventilated areas with ambient temperatures continuously maintained between 50 and 75 deg F.

- 1. Keep containers out of direct sunlight; avoid excessive heat and keep from freezing.
  - 2. Maintain containers in clean condition, free of foreign materials and residue.

3. Remove rags and waste from storage areas daily.

#### 1.07 CONDITIONS FOR COATING APPLICATION

- A. Comply with manufacturer's recommendations regarding required temperature and humidity ranges during coating application.

### PART 2 - PRODUCTS

#### 2.01 CORROSION-RESISTANT COATING SYSTEMS, GENERAL

- A. Material Compatibility:
  1. Provide materials for application within each coating system that are compatible with one another and with metal substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coating material in coating system, submit compatibility certification from manufacturer of each coating product that products are compatible with substrate base material and with substrate-coating products applied as earlier coats.
  3. Products shall be of same manufacturer for each coat in a coating system.
- B. Colors: Manufacturer's standard.

#### 2.02 AIR-DRIED CORROSION-RESISTANT COATING SYSTEMS

- A. Air-Dried, Spray-Applied Coating System.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Blygold America.
    - b. Heresite Protective Coatings.
    - c. Microguard.
    - d. Modine.
- B. Air-Dried Base Coat Performance Requirements:
  1. Corrosion Resistance: ASTM B117: 5000 hours.

2. Crosshatch Adhesion: ASTM D3359: 5B.
  3. Mandrel Flexibility: ASTM D522/D522M
  4. Heat-Transfer Reduction: 1 percent maximum.
  5. Hardness: ASTM D3363 Pencil Test: 2H or HBF.
- C. Air-Dried Topcoat Performance Requirements: Provide product with UV shielding properties, color stability, and maintenance of manufacturer's standard sheen, after exposure to outdoor conditions.
- D. Spray-Can Application Systems:
1. Type: Air dry, phenolic.

## 2.03 SOURCE QUALITY CONTROL

- A. Certification of Coating Material Testing: Submit manufacturer's test report of corrosion-resistance performance testing, as performed by a nationally recognized testing laboratory.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with coating manufacturer's requirements and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

### 3.02 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and coating systems indicated.
1. Thinning: Thin coating material with manufacturer's recommended thinning products when recommended or permitted by coating system manufacturer.

- B. Comply with coating system manufacturer's recommendations to clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

### 3.03 APPLICATION

- A. Verify with coating manufacturer whether coatings required must be applied and cured in factory-certified application shop.
- B. Apply coating systems with equipment designed to deposit coating of specified uniform thickness over HVAC components, in complex, three-dimensional geometries.
  - 1. Apply coatings with manufacturer-recommended tools and techniques suited for specified coating system and each coated HVAC component.
  - 2. Do not apply coatings over labels or equipment name, identification, performance rating, or nomenclature plates.
- C. Perform inspection and coating system manufacturer's recommended tests to verify coating integrity and thickness. Where coating was damaged by testing, repair damage in accordance with coating system manufacturer's written recommendations.

### 3.04 COATING SCHEDULE

- A. Exterior Equipment
  - 1. Air Dried Phenolic Coating Base Coat with UV Topcoat on equipment cabinets and all internal components including coils, fins, fans, and equipment.
- B. Interior Equipment
  - 1. Air Dried Phenolic Coating Base Coat on all internal components including coils, fins, fans, and equipment.

END OF SECTION

## SECTION 15810

### HVAC DUCTS AND CASINGS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

A. Section Includes:

1. Duct materials.
2. Ductwork fabrication.
3. Duct cleaning.

B. Related Requirements:

1. Section 03300 - Cast-in-Place Concrete: Requirements for concrete curbs as specified in this Section.
2. Section 09900 - Painting and Coating: Requirements for painting or coating as specified in this Section.
3. Section 15820 - Air Duct Accessories: Requirements for duct accessories as specified in this Section.

##### 1.02 REFERENCE STANDARDS

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE Handbook - Fundamentals.

B. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS D1.2 - Structural Welding Code - Aluminum.
3. AWS D9.1 - Sheet Metal Welding Code.

C. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A90 - Standard Test Method for Weight of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

3. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  4. ASTM A568 - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
  5. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  6. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
  7. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
  8. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
  9. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  10. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
  11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. International Code Council:
1. International Energy Conservation Code (IECC).
  2. International Mechanical Code (IMC).
- E. NFPA:
1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
  2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
  3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

F. Sheet Metal and Air Conditioning Contractors' National Association:

1. SMACNA 016 - HVAC Air Duct Leakage Test Manual.
2. SMACNA 1767 - Kitchen Ventilation Systems and Food Service Equipment Guidelines.
3. SMACNA 1884 - Fibrous Glass Duct Construction Standards.
4. SMACNA 1966 - HVAC Duct Construction Standards - Metal and Flexible.

G. UL:

1. UL 181 - Factory-Made Air Ducts and Air Connectors.
2. UL 181A - Closure Systems for Use With Rigid Air Ducts.
3. UL 1978 - Grease Ducts.

1.03 PREINSTALLATION MEETINGS

- A. Section 01200 - Administrative Requirements: Requirements for preinstallation meeting.
- B. Convene minimum one week prior to commencing Work of this Section.

1.04 SUBMITTALS

- A. Section 01340 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information for duct materials , duct liner , duct connectors.
- C. Shop Drawings:
  1. Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on sheets same size as Contract Drawings, indicating following:
    - a. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other Work.
    - b. Duct layout that further indicates pressure classifications and sizes in plan view; exhaust duct systems that further indicate classification of materials handled as specified in this Section.
    - c. Fittings.
    - d. Reinforcing details and spacing.



- e. Seam and joint construction details.
  - f. Penetrations through fire-rated and other walls.
  - g. Terminal unit, coil, and humidifier installations.
  - h. Hangers and supports, including methods for vibration isolation and building and duct attachment.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.
- F. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for following:
  - 1. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
  - 2. Materials, fabrication, assembly, and spacing of hangers and supports.
  - 3. Sheet metal thicknesses.
  - 4. Joint and seam construction and sealing.
  - 5. Reinforcement details and spacing.
- G. Test and Evaluation Reports: Indicate pressure tests performed, including date, section tested, test pressure, and leakage rate according to SMACNA 016.
- H. Manufacturer Instructions:
  - 1. Submit detailed instructions on installation requirements, including storage and handling procedures.
  - 2. Submit special procedures for glass-fiber ducts.
- I. Qualifications Statements:
  - 1. Submit qualifications for manufacturer, installer, and licensed professional.
  - 2. Submit manufacturer's approval of installer.
  - 3. Welders: Qualify procedures and personnel according to AWS D1.1 for hangers and supports, AWS D1.2 for aluminum supports, and AWS D9.1 for duct joint and seam welding.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents:
  - 1. Record actual locations of ducts and duct fittings.
  - 2. Record changes in fitting location and type.
  - 3. Show additional fittings used.

#### 1.06 QUALITY ASSURANCE

- A. Perform Work according to SMACNA 1884 and 1966.
- B. Construct ductwork to NFPA 90A standard.
- C. Maintain 1 copy of each standard affecting Work of this Section on Site.

#### 1.07 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.
- C. Welders: AWS qualified within previous 12 months for employed weld types.
- D. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Florida.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Materials and Equipment: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Provide additional protection according to manufacturer instructions.

## 1.09 AMBIENT CONDITIONS

- A. Section 01500 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Minimum Conditions: Do not install duct sealant when temperatures are less than those recommended by sealant manufacturer.
- C. Subsequent Conditions: Maintain temperatures during and after installation of duct sealant.

## 1.10 EXISTING CONDITIONS

- A. Field Measurements:
  - 1. Verify field measurements prior to fabrication.
  - 2. Indicate field measurements on Shop Drawings.

## 1.11 WARRANTY

- A. Section 01700 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish five-year manufacturer's warranty for ducts.

# PART 2 - PRODUCTS

## 2.01 DUCTS

- A. Performance and Design Criteria:
  - 1. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission of Architect/Engineer.
  - 2. Size round ducts installed in place of rectangular ducts according to ASHRAE Handbook - Fundamentals.
- B. Aluminum Ducts:
  - 1. Material: ASTM B209 aluminum sheet Alloy 3003-H14.
  - 2. Connectors and Bar Stock: Aluminum Alloy 6061-T6 or equivalent strength.
- C. Fasteners: Rivets, bolts, or sheet metal screws.

## 2.02 CASINGS

- A. Fabricate casings according to SMACNA 1966 and construct for indicated operating pressures.
- B. Doors:
  - 1. Reinforce access door frames with steel angles tied to horizontal and vertical plenum supporting angles.
  - 2. Furnish hinged access doors where indicated or required for access to equipment for cleaning and inspection.

## 2.03 FABRICATION

- A. Rectangular Ducts:
  - 1. According to SMACNA 1966.
  - 2. Provide duct material, gages, reinforcing, and sealing for indicated operating pressures.
- B. Tees, Bends, and Elbows:
  - 1. Minimum Radius:
    - a. 1-1/2 times centerline duct width.
    - b. If not possible or if rectangular elbows are used, provide airfoil turning vanes.
  - 2. If acoustical lining is indicated, furnish turning vanes of perforated metal with glass-fiber insulation.
- C. Divergence:
  - 1. Increase duct sizes gradually, not exceeding 15 degrees of divergence wherever possible.
  - 2. Upstream of Equipment: Maximum 30 degrees.
  - 3. Downstream of Equipment: Maximum 45 degrees.
- D. Welding:
  - 1. Continuously Welded Round and Oval Duct Fittings: Two gages heavier than duct gages according to SMACNA 1966.
  - 2. Cemented Slip Joints:

- a. Minimum 4 inches.
    - b. Brazed or electric welded.
  - 3. Prime coat welded joints.
- E. Takeoffs:
  - 1. Provide standard 45-degree lateral wye takeoffs.
  - 2. If not possible due to space limitations, provide 90-degree conical tee connections.
- F. Sealing:
  - 1. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.
  - 2. Sealants, Mastics, and Tapes: Comply with UL 181A and provide products bearing appropriate UL 181A markings.

## 2.04 ACCESSORIES

- A. Hangers and Supports:
  - 1. Riser Supports:
    - a. Supports for Aluminum Ducts: Aluminum or galvanized steel, coated with zinc chromate.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Section 01700 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify sizes of equipment connections before fabricating transitions.

### 3.02 PREPARATION

- A. Section 01700 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.

- C. Install temporary closures of metal or taped PE on open ductwork to prevent construction dust from entering ductwork system.

### 3.03 INSTALLATION

- A. Install and seal ducts according to SMACNA 1966.
- B. Glass-Fiber-Reinforced Ducts: Comply with SMACNA 1884.
- C. Insulated Flexible Duct Fittings:
  - 1. Join each flexible duct section to main trunk duct through sheet metal fittings.
  - 2. Material: Galvanized steel.
  - 3. Equip fittings with factory-installed volume damper having positive locking regulator.
  - 4. Provide insulation guard with fittings installed in lined ductwork.
- D. Hanger and Supports:
  - 1. Fabricate and support ducts according to SMACNA 1966.
  - 2. Threaded Rods: Provide double nuts and lock washers.
  - 3. Building Attachments:
    - a. Provide concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 4. Vertical Ducts:
    - a. Support with steel angles or channel secured to sides of duct with welds, bolts, sheet metal screws, or blind rivets.
    - b. Support at each floor and at maximum intervals of 5 feet.
  - 5. Upper Attachments:
    - a. Attach to structures.
    - b. Selection and Sizing: Provide pull-out, tension, and shear capacities as required for supported loads and building materials.
  - 6. Penetrations:
    - a. Avoid penetrations of ducts with hanger rods.

- b. If unavoidable, provide airtight rubber grommets at penetrations.

### 3.04 FIELD QUALITY CONTROL

- A. Section 15980 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- B. Testing:
  - 1. Ductwork Designed for 3-Inch wg above Ambient Pressure:
    - a. Pressure test minimum 25 percent of ductwork after duct cleaning but before duct insulation is applied or ductwork is concealed.
    - b. Comply with SMACNA 016.
    - c. Maximum Allowable Leakage: According to IECC.

### 3.05 CLEANING

- A. Vacuuming:
  - 1. Clean duct systems with high-power vacuum machines.
  - 2. Install access openings into ductwork for cleaning purposes.
- B. Protect sensitive equipment with temporary filters or bypass during cleaning.

### 3.06 ATTACHMENTS

- A. Ductwork Material Schedule:
  - 1. Return and Relief : Steel or aluminum.
  - 2. General Exhaust: Steel or aluminum.
  - 3. Outside Air Intake: Steel.
- B. Ductwork Pressure Class Schedule:
  - 1. Constant Volume Supply: 1-inch wg, regardless of velocity.
  - 2. Supply - Systems with Cooling Coils: 1/2-inch wg.
  - 3. General Exhaust: 1/2-inch wg.

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## SECTION 15830

### FANS

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

- A. Centrifugal Wall Fans
- B. High Volume Low Speed Fans.

##### 1.2 SUBMITTALS

- A. Comply with requirements and submit under provisions of Section 01330.
- B. Include a copy of this specification section; pertinent Contract Drawings; other relevant specification sections as noted above; and all addendum updates with each specification paragraph and Contract Drawing clearly check-marked to indicate compliance with specification and drawing requirements or marked to indicate requested deviations/substitutions from the specification requirements.
- C. Product Data: Product data for selected models, including specialties, accessories, certified fan performance curves, certified fan sound power ratings, motor ratings, and electrical characteristics.
- D. Shop Drawings: Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
- E. Wiring Diagrams: Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.
- F. Closeout Submittals: Provide maintenance data for fans for inclusion in Operating and Maintenance Manual specified in Section 01730.

##### 1.3 QUALITY CONTROL

- A. Regulatory Requirements:
  - 1. Comply with AMCA Standard 301, "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA Standard 300, "Test Code for Sound Rating."
  - 2. Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51, "Laboratory Methods of Testing Fans for Rating."
- B. Certificates: Fans shall bear the AMCA Certified Sound Ratings Seal.

## PART 2 - PRODUCTS

### 2.1 CENTRIFUGAL WALL FANS

- A. Manufacturers: Acme, Barry Blower, Carnes, Greenheck, Loren Cook, Jenn Fan, and Penn Ventilator, or equal.
- B. Direct-drive, centrifugal shall consist of housing, wheel, fan shaft, bearings, motor, drive assembly, curb base, and accessories.
- C. Housings shall be constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes and shall include OSHA approved motor guard
  - 1. Insulated Housing.
    - a. Thickness: 0.5 inches.
    - b. Shall be constructed of fiberglass liner.
- D. The fan wheel shall be aluminum hub and wheel with backward-inclined blades.
- E. Provide the following accessories:
  - 1. Disconnect Switch: Non-fusible type, with thermal overload protection, factory-wired through an internal conduit. For single phase motors include a control relay with dry contacts to indicate running status.
  - 2. Weather hood: Galvanized Steel, 45 degree with Bird Screen
  - 3. Wall Collar: Constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes.
- F. Capacities and Characteristics: As shown on Drawings

### 2.2 HIGH-VOLUME, LOW-SPEED FANS (HVLS)

- A. Manufacturers.
  - 1. Greenheck Fan Corporation.
  - 2. Loren Cook Company.
  - 3. Substitutions: Division 01- Product Options and Substitutions.
- B. Product Description: Factory-assembled and -tested horizontal, non-ducted fan unit, consisting of large-diameter blade set, direct-drive electric motor, with speed-reducing gearbox.
- C. Maximum Operating Temperature: 140 deg. F.
- D. Frame: Galvanized steel frame with thermoset polyester powder paint finish.
- E. Diameter: See drawings.

- F. Blades: Airfoil type constructed of aluminum.
- G. Motor: Provide with totally enclosed fan cooled or open drip proof enclosure.
- H. Wiring and Controls Enclosure: Provide NEMA 3 enclosure for non-corrosive areas where enclosure will also not be exposed to washdown or excessive moisture. Provide NEMA 4X enclosure in corrosive areas exposed to washdown procedures or excessive moisture.
- I. Controls: Provide wall-mounted keypad for fan control. Provide manual speed control for fan.

## 2.3 SOURCE QUALITY CONTROL

- A. Test fans in accordance with AMCA Standard 300, "Test Code for Sound Rating."
- B. Fans and shafts shall be statically and dynamically balanced.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install fans level and plumb in accordance with manufacturer's written instructions.
- B. Arrange installation of units to provide access space around fan for service and maintenance.

### 3.2 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Lubricate bearings.

### 3.3 CLEANING

- A. Adjusting, Cleaning, and Protecting: Adjust damper linkages for proper damper operation. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

END OF SECTION

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## SECTION 15855

### AIR OUTLETS AND INLETS

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

- A. Louvers.

##### 1.2 DEFINITIONS

- A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
- B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

##### 1.3 SUBMITTALS

- A. Product Data:
  - 1. For each model indicated, include the following:
    - a. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
    - b. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
    - c. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
    - d. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.
  - 2. Provide sufficient submittal data for air distribution devices to verify that required space sound levels will not be exceeded.

##### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. NFPA Compliance: Install equipment according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."
  - 2. Air Diffusion Council (ADC) Test Code 1062 and ASHRAE Test Standard 70-1991 for outlets and inlets.
  - 3. Air Movement and Control Association (AMCA) 500- Test Methods for Louvers, Dampers, and Shutters.

## 1.5 SYSTEM DESCRIPTION

- A. Performance Criteria: All equipment and material furnished under this section shall be selected so required NC sound levels in various spaces are not exceeded. Attenuation by ceilings, duct liner, and room absorption may be taken into account when making fan, terminal unit, and air distribution selections. Refer to the latest edition of the ASHRAE Applications Handbook for further information.

## PART 2 - PRODUCTS

### 2.1 LOUVERS

- A. Approved Manufacturer:
  - 1. Ruskin, Greenheck or equal.
- B. All louvers shall be tested in accordance with AMCA Standard 540 and shall bear the AMCA Certified Ratings Seal for both air performance and water penetration.
- C. Size and location as shown and/or scheduled on the drawings.
- D. Fixed Blade Aluminum Louvers:
  - 1. Extruded aluminum.
  - 2. Box frame with sill extension 6-inch-thick. Drainable heads.
  - 3. 3/4-Inch aluminum expanded metal bird screen with removable formed aluminum channel frame mounted on dry side.
  - 4. color by Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas where diffusers and grilles are to be installed for compliance with requirements for tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Louvers:
  - 1. Louvers shall be installed per architectural details and/or the manufacturer's recommendations.
  - 2. Frames shall be caulked weather-tight to structure

END OF SECTION

SECTION 15980  
TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General requirements for testing, adjusting, and balancing (TAB) the Division 15 environmental systems including (but not limited to) central heating/cooling units, air distribution systems, hydronic distribution systems, and the equipment and apparatus connected thereto.
- B. TAB report

1.2 SUBMITTALS

- A. Samples: Submit proposed TAB forms and report formats to Owner or his representative for approval at least 120 days prior to commencing field work and/or prior to installation of Division 15 environmental systems.
- B. Quality Assurance/Control Submittals: Qualifications – Within 30 days after contract award, submit the name(s) of the professional engineer and/or the NEBB or AABC certified supervisor who will be supervising this work. Submit the name(s) of the TAB technician(s) who will be performing the work.
- C. Closeout Submittals:
  - 1. TAB Report: After all balancing is complete, and all coordination with the Owner or his representative is complete, the balancing firm shall furnish four bound reports that shall contain the following information:
    - a. Belt and drive sheave information (as installed and as changed), fan nameplate information, motor nameplate information, and amperage and voltage to all motors (in various operating modes where applicable). Also, maximum and minimum rpm settings on VFD units.
    - b. Static pressure drops across all components of the air systems. Static pressure profile for each air handling unit system.
    - c. Required and final balanced cfm at each system terminal unit. Include the terminal size, inlet size, inlet static pressure, temperature, and velocities read to attain the required cfm.
    - d. Pump and motor nameplate information, amperage and voltage to all motors, flow and pressure drop across all system terminals, pressure rise across the pump in psi and feet of head, both operating and shut-off, and maximum operating gpm.
    - e. Refrigerant system operating amperages, pressures, and temperatures.

- f. Overload protection data for all motors shall be recorded. Starter and/or VFD brand, model, enclosure type, installed overload devices, original ratings and set points (and revised device ratings and set points when applicable) shall be recorded. If the starters (and/or VFDs) were furnished by the Mechanical Contractor, the overloads shall be verified and changed to the correct size when necessary, and so noted in the report. If the starters were furnished by the Electrical Contractor, the correct overload device sizes and settings shall be noted in the report and the Electrical Contractor shall be advised of all discrepancies.
  - g. The method of balance, the instruments used with calibration history, the project altitude, and any correction factors used in the calculations shall be reported.
  - h. A reduced set of drawings (11" x 17") shall be included in the report with all terminals (VAV boxes, air outlets, inlets, coils, unit heaters, fin tube loops, radiant panel loops, etc.) clearly marked, all equipment designated, and all referenced to the device test reports. The contract drawings may be reduced and used for this purpose, if they remain legible.
  - i. The TAB Contractor shall submit bound copies of the final testing and balancing report to the Owner or his representative at least 15 days prior to the Mechanical Contractor's request for final inspection. All data shall be recorded on applicable reporting forms. The report shall include all operating data as previously listed, a list of all equipment used in the testing and balancing work, and shall be signed by the supervising registered engineer or certified TAB supervisor and certified TAB technician, and affixed with his certification seal. Final acceptance of this project will not take place until a satisfactory report is received.
2. Balance report shall not be submitted until all improperly configured or installed systems are corrected and improperly installed or missing balance devices are corrected and tested reports submitted with incomplete information will be returned unreviewed.

### 1.3 QUALITY ASSURANCE

#### A. Qualifications:

- 1. The balancing work, including air and hydronic portions, shall be performed by the same firm having total professional responsibility for the final testing, adjusting, and balancing of the entire system.
- 2. TAB firm shall:
  - a. Have a permanent or temporary place of business and phone number within a 200-mile radius of the job site.
  - b. Have been actively engaged in balancing work within the State of Florida for at least three of the past five years. Provide at least three project references with phone numbers after award.
  - c. Have a minimum of two permanent employees who have been actively engaged in balancing work for a minimum of three (3) years. Provide names, certifications, and experience resumes after award.



3. The TAB field work shall be performed under the direct supervision of a registered Professional Engineer who has had at least five years of balancing experience in the state in which the work is being done or a NEBB or AABC certified TAB supervisor. The PE or certified supervisor may:
  - a. Perform the TAB work or be on-site at least 33% of the total time the TAB work is in progress, or
  - b. Be on site a minimum of 10% of the total time the TAB work is in progress with the work performed by a full-time certified TAB Technician who has been certified by the Sheet Metal Industry National Certification Board.

B. Certifications:

1. Testing, adjusting, and balancing shall be done by a firm using NEBB or AABC certified supervisors, or by an independent firm specializing in this work. A definition of independent shall mean the firm is not associated with the Mechanical Contractor performing work under Division 15; the firm derives its income solely from testing, adjusting, and balancing and/or commissioning mechanical systems, and the work is performed in a professional manner.
2. TAB firm shall own or rent and have available for this project all necessary balancing instruments as required to maintain NEBB or AABC certification. Instrument calibration shall have been checked and verified as per NEBB requirements. Provide instrument list with calibration date for each instrument listed.

C. Regulatory Requirements:

1. Comply with procedural standards for testing, adjusting, and balancing of environmental systems as outlined in the latest edition of SMACNA, NEBB, and/or AABC procedural manuals.
2. Applicable sections and paragraphs as published in ASHRAE 1995 Applications Handbook, Chapter 34, Testing, Adjusting, and Balancing, and Standard 111-1988.

1.4 SCHEDULING

- A. Coordinate scheduling of work with the General Contractor, the appropriate subcontractors:
  1. Schedule TAB work to coincide with testing and verification of control systems where practical.
- B. Provide written notification (within 24 hours) to General Contractor, Engineer, and Owner or his representative of any component and/or system deficiencies.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Provide all necessary tools, scaffolding, and ladders.

- B. Provide all necessary instruments. Calibration and maintenance of instruments shall be in accordance with SMACNA, NEBB, AABC, and/or the manufacturer's standards and recommendations. Calibration histories for each instrument shall be available for examination.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Air and water testing and balancing shall not begin until the system to be tested has been cleaned and flushed, and is in full working order. Where glycol is used, it shall be installed prior to hydronic balancing.
- B. Visual observations at the site during construction shall have been made to determine the location of required balancing devices, that they are being installed properly, and that proper access is provided.
- C. Prior to and during testing and balancing, TAB contractor shall immediately notify the Contractor of all balancing devices not yet installed and those portions of the system unable to be balanced. The Contractor shall correct the deficiencies and shall notify the Engineer of situations requiring additional instruction.
- D. Before any air balance work is done, the system shall be checked for:
  - 1. Excessive duct leakage
  - 2. Dirt and debris in ducts and/or AHUs
  - 3. Filters are installed (and changed if they are dirty)
  - 4. Coil fins are clean and combed where needed
  - 5. Correct motor rotation
  - 6. Excessive vibration
  - 7. Equipment lubrication
  - 8. Manual control dampers, fire dampers, and air outlet dampers are wide open
  - 9. Duct end caps installed and access doors closed
  - 10. Grilles, registers, and diffusers are properly installed
- E. Put heating, ventilating, and air conditioning systems and equipment into full operation and continue operation of same during each working day of testing and balancing.

#### 3.2 REQUIREMENTS OF WORK

- A. Adjust air handling systems to the following tolerances:
  - 1. Supply systems shall be balanced so that:
    - a. The total quantity to each space is within -5% to +10% of design values.
    - b. If two outlets in space, each outlet is within -10% to +10% of design value.
    - c. If three or more outlets in space, each outlet is within -15% to +15% of design value.
  - 2. Exhaust and return systems shall be balanced so the total quantity from each space is -10% to +10% of design values.

B. Air Balance:

1. The exhaust fan static pressures shall be set by the balancing firm (and the Controls Contractor if the systems have fan volume control).
    - a. System static pressure profiles and fan motor amperages shall be recorded in all modes.
    - b. The lowest fan speed resulting in satisfactory system performance shall be determined at full design delivery. Any inlet or outlet fan volume (balancing) dampers shall be in the wide-open position and one path presenting the greatest resistance to flow shall be fully open and unobstructed.
    - c. After balancing, all adjustable speed sheaves 7-1/2 hp and larger shall be replaced with fixed-speed sheaves by the TAB Contractor.
  2. Building static pressure adjacent to entries shall be measured and recorded. Adjust systems to maintain a positive pressure of 0.05-inch w.c. when possible. Note any discrepancies.
  3. Final adjustments shall include but not be limited to the following:
    - a. Fans:
      1. VFD Drive: Coordinate VFD startup with the applicable Division 15 vendor. Adjust maximum and minimum rpm settings as necessary to obtain design cfm. Verify that ramp-up and down adjustments are made as necessary to prevent overshoot and "hunting."
      2. Direct Drive:
        - a. RPM with Speed Taps: Set fan speed on tap that most closely approaches design cfm. Report tap setting on equipment data sheet.
        - b. RPM with Speed Control Rheostat: Set output of fan to design cfm by adjusting the SCR. After adjustment, check fan's ability to restart after powering down. Increase SCR setting if required for proper starting.
        - c. CFM with Variable Pitch Blades: Variable fixed pitch fan blades and variable in-motion pitch fan blades shall be adjusted initially by the manufacturer at pitch required to provide design output. Check and readjust if necessary to obtain design cfm. Pitch angle adjustment shall not exceed recommended maximum to prevent "stall."
    - b. Outside Air:
      1. Quantity of OSA: Shall be measured directly using a velocity traverse (or pitot tube traverse when separately ducted), or shall be calculated using return air, OSA, and resultant mixed air temperatures.
  4. When air balancing is done and manual dampers are set, all test holes shall be plugged and all manual damper positions shall be marked. The following information shall be recorded in the final report: Design inlet or outlet size, actual inlet or outlet size, and design cfm (velocity) through the orifice for each terminal in the system.
- C. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

### 3.3 FIELD QUALITY CONTROL

- A. Upon request of the Engineer, a representative of the balancing firm performing the work shall demonstrate to him fluid flow quantities shown in the report by reading back outlets or terminals selected at random by the Engineer. It is understood that the operating mode of the system shall be the same for readback as it was during balancing, and the number of readings verified will not exceed 10% of the total in the report.
- B. When deemed necessary by the Owner or Engineer, the balancing firm shall run temperature, pressure, and/or humidity recordings, and shall be prepared to verify any of the report test results in the presence of the Owner and/or Engineer when requested.
- C. When deemed necessary by the Engineer, a 24-hour space temperature recording shall be taken and any required partial rebalance of the system shall be performed without any additional cost.

END OF SECTION

## SECTION 16050

### BASIC ELECTRICAL REQUIREMENTS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: General administrative, procedural requirements, and installation methods for electrical installations specified in Division 16.
- B. The Drawings are schematic and are not intended to show every detail of construction.
  - 1. In general, conduits/raceways, transitions and offsets shown on Drawings indicate approximate locations in plan and elevation where the systems are intended to be run.
  - 2. CONTRACTOR shall fully coordinate electrical Work with other trades to avoid interferences.
  - 3. In the event of interferences, CONTRACTOR shall request clarification from ENGINEER in writing.
- B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Sections, apply to Work of this Section.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with requirements of Section 01340, Shop Drawings covering the items included under this Section of Work. Shop Drawing submittals shall include:
  - 1. Submit product data covering the items included under this Section of Work.
- B. Conforming to Construction Drawings: Submit a complete set of Drawings showing the locations of the piping, ductwork, etc., as actually installed. Such Drawings shall be submitted to ENGINEER in electronic format (PDF)..
- C. Operation and Maintenance Manuals: Submit in accordance with requirements of Section 01600, operation and maintenance manuals for items included under this Section. Include following information for equipment items:
  - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
  - 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.
  - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
  - 4. Servicing instructions and lubrication charts and schedules.

##### 1.03 RECORD DOCUMENTS

- A. Prepare Record Documents in accordance with requirements in Section 01770. In addition, CONTRACTOR shall submit, prior to final payment, Drawings conforming to construction records of systems it has installed. Vendor drawings shall be sized as manufacturers' standard.
- B. Provide typewritten data sheets on motor control circuits with following information on each branch feeder: Load name, horsepower or KVA (transformer), fuse size, starter size, service factor of motor, motor nameplate currents, power factor correction capacitor size (if used), and thermal overload part number.

#### 1.04 QUALITY ASSURANCE

- A. National Electrical Code: Comply with NFPA 70, National Electrical Code.
- B. UL Compliance and Labeling: Use products and components labeled by UL.

#### 1.05 PERMITS, INSPECTIONS, AND LICENSES

- A. CONTRACTOR shall procure all necessary permits and licenses, observe and abide by all applicable laws, codes, regulations, ordinances, and rules of the State, territory, or political subdivision thereof, wherein Work is done, or any other duly constituted public authority, and further agrees to hold OWNER harmless from liability or penalty which might be imposed by reason of an asserted violation of such laws, codes, regulations, ordinances, or other rules.
  - 1. Upon completion of Work, CONTRACTOR shall secure certificates of inspection from the inspector having jurisdiction and shall submit 3 copies of the certificates to OWNER. CONTRACTOR shall pay the fees for the permits, inspections, licenses, and certifications when such fees are required.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification. Equipment shall be packaged to prevent damage during shipment, storage, and handling. Do not install damaged units; replace, and remove damaged units from Site.

### PART 2 - PRODUCTS

NOT USED

### PART 3 - EXECUTION

#### 3.01 GENERAL ELECTRICAL INSTALLATION

- A. Provide electrical materials and equipment enclosures appropriate for areas in which they are installed. Indoor areas will be designated as NEMA 12 in office or administration areas. Indoor process or mechanical areas will be designated at NEMA 4X areas. Outdoor areas will be designated

as NEMA 4X areas. An area designated by a name and elevation includes space bounded by floor, ceiling, and enclosing walls.

1. Exception: Provide manufacturer's standard construction for indoor or outdoor application where equipment is not manufactured to NEMA specifications (e.g., switchgear, transformers, high voltage capacitors, bus duct, and light fixtures; materials and equipment used in finished areas such as offices, laboratories, etc.).
- B. Provide nonmetallic electrical materials and equipment enclosures in NEMA 4X areas; watertight NEMA 4 and equipment enclosures for outdoor applications and indoor applications below grade;
- C. Provide chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
- D. Supporting devices and sleeves shall be set in poured-in-place concrete and other structural components as they are constructed.
- E. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom possible. Locate light fixtures at approximately 8 feet above floor and where fixtures may be readily serviced.
- F. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by Drawings recognizing that portions of Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to ENGINEER.
- G. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components where installed exposed in finished spaces.
- H. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.
- I. Install access panel or doors where units are concealed behind finished surfaces..
- J. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

### 3.02 RACEWAY INSTALLATION

- A. Outdoors, use the following materials:
  1. Exposed Conduit: Rigid Metal Conduit and fittings.
  2. Underground Direct Buried Conduit: non metallic conduit.
  3. Conduit Used to Connect to Vibrating Equipment including transformers and hydraulic, pneumatic or electric solenoid or motor-driven equipment: Liquidtight flexible metal conduit.
- B. Indoors, use the following wiring materials:
  1. Connection to Vibrating Equipment, including transformers and hydraulic, pneumatic or electric solenoid or motor-operated equipment: Liquidtight flexible metal conduit.

2. Exposed Conduit: Rigid metal conduit.
    - a. Exceptions:
      - 1) Areas indicated as NEMA 4X, use rigid Schedule 80 PVC conduit.
  3. Concealed Conduit: Rigid metal conduit.
- C. Minimum size conduit shall be 3/4 inch unless shown otherwise.
- D. Instrument Signal Conduit Requirements: Shielded signal wires for 4-20 mA type instruments or thermocouple wires assigned to the same control panel may be run in the same conduit. Shielded instrument signal wires, thermocouple wires, and shielded 2-wire intercom wires may be run in the same conduit. No other wires will be permitted in an instrument signal/2-wire intercom conduit. Conduit shall be RMC or PVC-coated RMC.
- E. Conduit Thread Paint: Make threaded conduit joints watertight by coating threaded portions with a spray-on or brush-on zinc-bearing paint. Provide paint containing 90 percent minimum by weight of metallic zinc powder in the dried film. Clean field-cut threads of oil using the recommended solvent prior to coating threads.
- F. Install expansion fittings in all exposed rigid nonmetallic conduit runs of 20 feet or more.
- G. Install expansion/deflection fittings where conduit passes a building expansion joint or where conduits are attached to two structures joined by a concrete expansion joint.
- H. Exposed or Concealed Construction: Install conduit exposed inside buildings except for areas with finished walls (e.g., offices, laboratories, lavatories, locker rooms, etc.) unless otherwise indicated.
- I. Concealed Raceways: Raceways embedded in slabs shall be installed in the middle third of the slab thickness where practical and leave at least 1-inch concrete cover. Tie raceways to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Space raceways laterally to prevent voids in the concrete. Run 1-inch and smaller raceways with a minimum of bends in the shortest practical distance. Run larger conduit parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab. Where nonmetallic conduit or fiberglass-reinforced conduit is used, raceways must be converted to PVC externally coated rigid metal conduit before rising above floor.
- J. Exposed Raceways: Install parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical. Make bends and offsets so the inside diameter is not effectively reduced. Keep the legs of a bend in the same plane and the straight legs of offsets parallel. Conduits shall slope away from loads to keep moisture from entering the load. Run parallel or banked raceways together. Make bends in parallel or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run, such as from wall to ceiling and that the raceways be of the same size. In other cases, provide field bends for parallel raceways. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.



- K. Space raceways, fittings, and boxes 0.25 inch from mounting surface in NEMA 4 and NEMA 7 areas. Spacers shall be one-piece construction of stainless steel, galvanized steel, PVC, ABS, or other noncorrosive material.
- L. Sleeves: Install in concrete floor slabs except where conduit passes through a housekeeping pad. Install in exterior walls below grade.
- M. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid metal conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs with floor.
- N. Flexible Connections: Use short length (maximum 6 feet for lighting fixtures; maximum 3 feet for all other equipment) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement, and all motors. Use liquidtight flexible conduit in wet locations and rated flexible connections for hazardous locations. Install separate ground conductor across flexible connections.
- O. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.
- P. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate metal conduit, use threaded rigid metal conduit fittings. For PVC externally coated rigid metal conduit, use only factory-coated fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduit.
- Q. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL listed sealing compound. For concealed raceways, install each fitting in a flush metal box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
  - 1. Where conduits enter or leave hazardous locations.
  - 2. Where conduits enter or leave NEMA 4X areas.
  - 3. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
  - 4. Where required by the NEC.
- R. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- S. Install device boxes at the height above the floor as follows for:
  - 1. Light switches, 4 feet.
  - 2. Receptacles and telephone jacks, 18 inches except in NEMA 4 and 4X areas, 4 feet.

- T. Avoid installing boxes back-to-back in walls. Provide not less than 6-inch (150 mm) separation.
- U. Position recessed outlet boxes accurately to allow for surface finish thickness.
- V. Fasten electrical boxes firmly and rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete masonry.
- W. Provide fire-retardant barriers in all pull and junction boxes containing circuits that are otherwise continuously separated in conduit. Securely fasten these barriers within box. Size barriers so that space between barrier and box wall does not exceed 0.125 inch anywhere around the perimeter of barrier.
- X. Support exposed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
- Y. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from building structure.
- Z. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box and tighten the chase nipples so no threads are exposed.
- AA. Complete installation of electrical raceways before starting installation of conductors within raceways and prevent foreign matter from entering raceways by using temporary closure protection. Cap spare conduit. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- BB. Install pull wires in empty raceways: Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-pound tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

### 3.03 WIRE AND CABLE INSTALLATION

- A. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant where necessary.
- B. Keep branch circuit conductor splices to minimum. Splice feeders only where indicated. Use a standard kit. No splices are allowed for instrument and telephone cables except at indicated splice points.
- C. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors which are compatible with conductor material and are UL listed as pressure type connectors.

- D. Provide adequate length of conductors within electrical enclosures and train conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at terminal.
- E. Terminate power conductors at equipment using pressure-type terminals specifically designed for type of terminations to be made. Terminate no more than 2 conductors No. 8 AWG and smaller within the same pressure-type terminal. These 2 conductors shall be no more than 4 wire gauge sizes apart. Terminate no more than 1 conductor larger than No. 8 AWG within any pressure-type terminal.
  - 1. Exception: Power factor correction capacitor conductors may be terminated at the motor disconnect switch load terminals.
- F. Seal wire and cable ends until ready to splice or terminate.

### 3.04 CUTTING AND PATCHING

- A. Perform cutting and patching in accordance with requirements.
  - 1. Perform cutting, fitting, and patching of electrical equipment and materials required to uncover Work to provide for installation of ill-timed Work, remove and replace Work that is either defective or does not conform to requirements of Drawings.
  - 2. Cut, remove, and legally 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 new Work. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.
  - 3. Patch existing finished surfaces and building components using new materials matching existing materials.

### 3.05 EQUIPMENT CHECKOUT AND TESTING

- A. In addition to testing recommended by equipment or material supplier and called for in equipment or material specification, perform the following.
- B. Motor Testing: Motor insulation shall be tested by using a 500 VDC (minimum) megger and applying test until a constant megohm reading of the following magnitude is obtained:

$$R_{\min.} = 4 (KV + 1) \text{ at } 25 \text{ degrees C winding temp.}$$

$$R_{\min.} = IV + 1 \text{ at } 40 \text{ degrees C winding temp.}$$

- 1. If motors do not meet requirements of megger test, blow hot air through motors to dry out and repeat until test is passed. If desirable, drying can be done by applying an electrical potential to equipment. However, in no case, induced or direct, shall voltage or current exceed continuous rating of equipment being dried.
- 2. After passing megger test, motors shall be hi-pot tested at 200 percent rated voltage for a minimum of 1 minute.

- C. Equipment Testing: The following tests which are applicable for a particular item of equipment shall be performed:
1. Megger bus work phase-to-phase and phase-to-ground. Minimum acceptable steady-state value is 100 megohms.
  2. Megger power circuit breakers and circuits supplied phase-to-phase and phase-to-ground (100 megohms minimum).
  3. Test current transformer circuits by applying current to secondary wiring at current transformer terminals until contactor trips.
  4. Test, time, and set protective relays. Relays shall be timed at various multiples (minimum of 3 points) of the pick-up value to determine agreement with published curves and adjust as necessary to agree with coordination study required settings. Exact tests to be performed vary with type of relay. Manufacturer's instructions for relay shall be complied with.
  5. After Work has been completed, demonstrate to OWNER's Representative that entire electrical installation is in proper working order and will perform functions for which it was designed by functional testing.
  6. Make any specific tests required by the manufacturer's installation instructions.
- D. Check-out Procedures. In general, check-out procedures (as listed below) which are applicable for a particular item of equipment shall be performed:
1. Vacuum interior of cubicles and remove foreign material.
  2. Wipe clean with a lint-free cloth insulators, bushings, bus supports, etc.
  3. Check and adjust time delay, under-voltage devices, phase relay, over-current relays, etc., as required by coordination study or ENGINEER.
  4. Fill motor bearings requiring oil.
  5. Check and change, as required, thermal overload heater elements to correspond with motor full-load current and service factors of installed motor.
  6. Check direction of rotation of motors and reverse connections if necessary. Check rotation with motor mechanically uncoupled where reverse rotation could damage equipment.
  7. Equipment with two or more sources of power connected by tie breakers, transfer switches, or generator receptacles shall be checked for rotation from each possible combination of power sources. Power sources must have the same phase sequence for each source throughout entire facility.
  8. Check exposed bolted power connections for tightness.
  9. Check operation of breakers, contactors, etc., and control and safety interlocks.
  10. Check tightness of bolted structural connections.
  11. Check leveling and alignment of enclosures.
  12. Check operating parts and linkages for lubrication, freedom from binding, vibration, etc.
  13. Check tightness and correctness of control connections at terminal blocks, relays, meters, switches, etc.
  14. Clean auxiliary contacts and exposed relay contacts after vacuuming.

END OF SECTION

## SECTION 16060

### GROUNDING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Electrical grounding and bonding Work as follows:
  - 1. Solidly grounded.
- B. Applications of electrical grounding and bonding Work in this Section:
  - 1. Underground metal structures.
  - 2. Metal building frames.
  - 3. Electrical power systems.
  - 4. Grounding electrodes.
  - 5. Separately derived systems.
  - 6. Raceways.
  - 7. Service equipment.
  - 8. Enclosures.
  - 9. Equipment.
  - 10. Lighting standards.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

##### 1.03 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. UL Compliance: Comply with applicable requirements of UL Standards No. 467, "Electrical Grounding and Bonding Equipment," and No. 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL listed and labeled for their intended usage.
  - 2. IEEE Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141, and 142 pertaining to grounding and bonding of systems, circuits, and equipment.

#### PART 2 - PRODUCTS

##### 2.01 GROUNDING AND BONDING

A. Materials and Components:

1. Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for complete installation. Where more than one type component product meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications indicated.
2. Conductors: Electrical copper grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.
3. Ground Bus: 0.25 inch by 1 inch minimum copper ground bus where indicated.
4. Grounding Electrodes: Steel with copper welded exterior, 3/4-inch diameter by 10 feet.
5. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

- A. Connect grounding conductors to underground grounding electrodes using exothermic weld process or mechanical compression type connectors.
- B. Ground electrical service system neutral at service entrance equipment to grounding electrodes.
- C. Ground each separately derived system neutral to effectively grounded metallic water pipe, effectively grounded structural steel member, and separate grounding electrode.
- D. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- E. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug, bus, or bushing.
- F. Connect grounding electrode conductors to 1-inch diameter or greater, metallic cold water pipe using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.
- G. Connect building reinforcing steel, building steel beam, building steel roof and walls and duct bank and vault reinforcing steel to ground mat using No. 4/0 AWG bare copper grounding cable.
- H. Bond bare No. 4/0 AWG grounding cable in duct banks to grounding cable in vaults and to power equipment ground bus at ends of each duct bank.
- I. Bond strut and other metal inside of electrical manholes and vaults to bare No. 4/0 AWG grounding cable carried in duct bank.

- J. Bond grounding cables to both ends of metal conduit or sleeves through which such cables pass.
- K. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque-tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
- L. Install braided type bonding jumpers with code-sized ground clamps on water meter piping to electrically bypass water meters.
- M. Route grounding connections and conductors to ground and protective devices in shortest and straightest paths as possible while following building lines to minimize transient voltage rises. Protect exposed cables and straps where subject to mechanical damage.
- N. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed and are subjected to corrosive action.

### 3.02 FIELD QUALITY CONTROL

- A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester using the 3-point fall of potential method. Testing shall be performed during normal dry weather conditions with at least 5 non-rain days elapsing prior to test. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms or less by driving additional ground rods; then retest to demonstrate compliance.

END OF SECTION

## SECTION 16070

### SUPPORTING DEVICES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product data for each type of product specified.

##### 1.03 QUALITY ASSURANCE

- A. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Slotted Metal Angle and U-Channel Systems:
    - a. Allied Tube & Conduit.
    - b. American Electric.
    - c. B-Line Systems, Inc.
    - d. Cinch Clamp Co., Inc.
    - e. GS Metals Corp.
    - f. Haydon Corp.
    - g. Kin-Line, Inc.
    - h. Unistrut Diversified Products.
  - 2. Conduit Sealing Bushings:
    - a. Bridgeport Fittings, Inc.
    - b. Cooper Industries, Inc.
    - c. Elliott Electric Mfg. Corp.
    - d. GS Metals Corp.
    - e. Killark Electric Mfg. Co.
    - f. Madison Equipment Co.
    - g. L.E. Mason Co.



- h. O-Z/Gedney.
- i. Producto Electric Corp.
- j. Raco, Inc.
- k. Red Seal Electric Corp.
- l. Spring City Electrical Mfg. Co.
- m. Thomas & Betts Corp.

## 2.02 COATINGS

- A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors, in NEMA 4 areas, or embedded in concrete shall be hot-dip galvanized.

## 2.03 MANUFACTURED SUPPORTING DEVICES

- A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
- B. Fasteners. Types, materials, and construction features as follows:
  - 1. Expansion Anchors: Stainless Steel wedge or sleeve type.
  - 2. Toggle Bolts: Stainless Steel springhead type.
  - 3. Hanger Rods: 0.375-inch diameter minimum, stainless steel.
- C. Conduit Sealing Bushings: Factory fabricated, watertight conduit sealing bushing assemblies suitable for sealing around conduit or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
- D. Cable Supports for Vertical Conduit: Factory fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable iron casting with hot-dip galvanized finish.
- E. U-Channel Systems: 12 gauge or 0.105-inch-thick stainless steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center in top surface. Provide fittings and accessories that mate and match with U-channel and are of same manufacturer.

## 2.04 FABRICATED SUPPORTING DEVICES

- A. Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
- B. Aluminum Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

- C. Pipe Sleeves: Provide a waterstop on pipe sleeves. Provide pipe sleeves of 2 standard sizes larger than conduit/pipe passing through it and of one of the following:
  - 1. Sheet Metal: Fabricate from aluminum sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gauge metal for sleeve diameter noted:
    - a. 3-inch and smaller: 20-gauge.
    - b. 4-inch to 6-inch: 16-gauge.
    - c. Over 6-inch: 14-gauge.
  - 2. Rigid Pipe: Fabricate from Schedule 40 aluminum pipe.

### PART 3 - EXECUTION

NOT USED

END OF SECTION

## SECTION 16075

### ELECTRICAL IDENTIFICATION

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including, but not limited to, the following:
  - 1. Buried electrical line warnings.
  - 2. Identification labeling for cables and conductors.
  - 3. Operational instruction signs.
  - 4. Warning and caution signs.
  - 5. Equipment labels and signs.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product Data for each type of product specified.

#### PART 2 - PRODUCTS

##### 2.01 ELECTRICAL IDENTIFICATION PRODUCTS

- A. Colored Adhesive Marking Tape for Wires and Cables: Self-adhesive, vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.
- B. Pre-tensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: Flexible acrylic bands sized to suit raceway diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.
- C. Underground Line Marking Tape: Permanent, bright colored, continuous printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.
- D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with pre-printed numbers and letter.
- E. Aluminum, Wraparound Cable Marker Bands: Bands cut from 0.014-inch-thick aluminum sheet, fitted with slots or ears for securing permanently around wire or cable jacket or around groups of conductors. Provide for legend application with stamped letters or numbers.

- F. Engraved, Plastic Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16 inch minimum thick for signs up to 20 square inches or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letters on black face and punched for mechanical fasteners.
- G. Baked Enamel Warning and Caution Signs for Interior Use: Pre-printed aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.
- H. Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, nonfading, pre-printed cellulose acetate butyrate signs with 20-gauge galvanized steel backing, with colors, legend, and size appropriate to location. Provide 1/4-inch grommets in corners for mounting.
- I. Fasteners for Plastic Laminated and Metal Signs: Self-tapping stainless steel screws or Number 10/32 stainless steel machine screws with nuts and flat and lock washers.
- J. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18 inch minimum width, 50-pound minimum tensile strength, and suitable for a temperature range from minus 50 to 350 degrees F. Provide ties in specified colors when used for color coding.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification Work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by Code.
- B. Underground Electrical Line Identification: During trench backfilling for exterior nonconcrete encased underground power, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench, do not exceed an overall width of 16 inches; install a single line marker.
- C. Install line marker for underground wiring, both direct buried and in raceway.
- D. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the Project secondary electrical system following OWNER's method of phase identification or as follows:
- E. Wiring Standards:
  - 1. 480/277 Volt, 3-Phase Power:
    - a. Brown.
    - b. Orange.
    - c. Yellow.
    - d. Grey Neutral.
  - 2. 208 Volt, 3-Phase Power:
    - a. Black.

- b. Red.
    - c. Blue.
  - 3. 240/120 Volt, 1-Phase Power:
    - a. Black.
    - b. Red.
    - c. White Neutral.
  - 4. Motor Leads, Control Cabinet/MCC:
    - a. Black, numbered L1-T1, etc.
  - 5. Control Wiring:
    - a. Red Control circuit wiring that is de-energized when the main disconnect is opened.
    - b. Yellow Control circuit wiring that remains energized when the main disconnect is opened.
    - c. Blue DC.
    - d. Green Ground.
- F. Use conductors with color factory applied entire length of conductors except as follows:
  - 1. The following field applied color coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
    - a. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last 2 laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
    - b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply 3 ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.
- G. Power Circuit Identification: Securely fasten identifying metal tags of aluminum wraparound marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-pound test monofilament line or one-piece self-locking nylon cable ties.
- H. Install wire/cable designation tape markers at termination points, splices, or junctions in each circuit. Circuit designations shall be as indicated on Drawings.

END OF SECTION

## SECTION 16120

### WIRES AND CABLES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section includes the following:
  - 1. Low-Voltage Wire and Cable.
  - 2. Local Area Network Wiring (LAN).

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Include Shop Drawings of wires, cables, connectors, splice kits, and termination assemblies.
- B. Reports of field tests prepared as noted in Section 01600.

##### 1.03 QUALITY ASSURANCE

- A. UL Compliance: Provide components which are listed and labeled by UL. For cables intended for use in air handling space comply with applicable requirements of UL Standard 710, "Test Method for Fire and Smoke characteristics of cables used in Air Handling Spaces."
- B. NEMA/ICEA Compliance: Provide components which comply with following standards:
  - 1. NEMA WC 70-1999/ICEA S-95-658-1999, Nonshielded Power Cables Rated 2,000 Volts or Less for the Distribution of Electrical Energy.
- C. IEEE Compliance: Provide components which comply with the following standard.
  - 1. Standard 82, Test procedures for Impulse Voltage Tests on Insulated Conductors.
- D. Network Wiring Experience: CONTRACTOR must be able to prove to the satisfaction of OWNER that it has significant experience in the installation of Local Area Network cable systems. Installation must include installation of Network cable, cable termination, knowledge of interconnect equipment, and a thorough knowledge of testing procedures.
- E. Labeling: Handwritten labels are not acceptable. All labels shall be machine printed on clear or opaque tape, stenciled onto adhesive labels, or typewritten onto adhesive labels. The font shall be at least 1/8 inch in height, block characters, and legible. The text shall be of a color contrasting with the label such that it may be easily read. If labeling tape is utilized, the font color shall contrast with the background. Patch panels shall exhibit workstation numbers or some type of location identifier, in sequential order, for all workstations or devices attached. Each Network cable segment shall be labeled at each end with its respective identifier.

- F. Patch Cords: Patch cords shall be provided for each Local Area Network port on the patch panel. Patch cords shall meet or exceed technical specifications of all installed Local Area Network cable. Patch cord connectors shall be matched with patch panel connector type and network module connector type as required.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Low-Voltage Wire and Cable:
    - a. American Insulated Wire Corp.
    - b. General Cable.
    - c. The Okonite Co.
    - d. Southwire Co.
  - 2. Connectors for Low-Voltage Wires and Cable Conductors:
    - a. AMP.
    - b. O-Z/Gedney Co.
    - c. Square D Company.
    - d. 3M Company.
  - 3. Local Area Network Cable:
    - a. Belden 7882A/7883A, or equal.

### 2.02 LOW-VOLTAGE WIRES AND CABLES

- A. Conductors: Provide stranded conductors conforming to ASTM Standards for concentric stranding, Class B. Construction of wire and cable shall be single conductor (1/c) unless multiconductor cable is shown by notation in form (x/c) where x indicates the number of separate insulated conductors per cable.
- B. Conductor Material: Copper. Minimum size power wire shall be No. 12 AWG.
- C. Insulation: Provide XHHW,insulation for power conductors used in single- and 3-phase circuits with more than 120 volts to ground. ProvideXHHW, or THWN/THHN insulation for power conductors used in single- and 3-phase circuits with 120 volts or less to ground
  - 1. Provide THHN/THWN, or XHHW insulation for grounding conductors installed in raceways.
  - 2. Provide THHN/THWN insulation for control conductors.

### 2.03 CONNECTORS FOR LOW-VOLTAGE WIRES AND CABLES

- A. Provide UL listed factory fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types, and classes for applications and services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

## 2.04 LOCAL AREA NETWORK CABLE

- A. Category 6 (Ethernet) Data and Patch Cable:
  - 1. Paired, 4-pair, 24 AWG, solid bare copper conductors with polyethylene insulation, overall aluminum foil-polyester tape shield with 24 AWG stranded tinned copper drain wire, 100 percent shield coverage, PVC jacket.
  - 2. UL verified to Category 6.
  - 3. Provide plenum rated cable where installed exposed.

## PART 3 - EXECUTION

### 3.01 FIELD QUALITY CONTROL

- A. Prior to energizing, check installed 480 volt, 3-phase power circuits and higher wires and cables with a 1,000-volt megohm meter to determine insulation resistance levels to assure requirements are fulfilled. Minimum acceptable megohm meter reading is 100 megohms held at a constant value for 15 seconds. A certified copy of megohm meter tests shall be submitted to ENGINEER. Test reports shall include ambient temperature and humidity at time of testing. Notify ENGINEER 48 hours prior to test with schedule.
- B. Local Area Network (LAN) Cable Tests: Testing of all cable segments shall be completed in compliance with EIA/TIA-568-B.1 Standards. Testing shall be done by CONTRACTOR with at least 5 years of experience in testing Network cabling systems.
  - 1. TESTING: CONTRACTOR shall test each network cable segment. **OWNER reserves the right to have representation present during all or a portion of the testing process. CONTRACTOR must notify OWNER 5 days prior to commencement of testing.** If OWNER elects to be present during testing, test results will only be acceptable when conducted in the presence of OWNER.
  - 2. DOCUMENTATION (Network Cable): CONTRACTOR shall provide documentation to include test results and as-built Drawings. Network Cable Results: Handwritten results are acceptable provided the test is neat and legible. Copies of test results are not acceptable. Only original signed copies will be acceptable.
    - a. Each cable installed shall undergo complete testing in accordance with TIA/EIA-568-B.1 to guarantee performance to this Standard.
    - b. All required documentation shall be submitted within 30 days at conclusion of the project to OWNER.
    - c. Test Criteria: Pass rate to conform to latest TIA/EIA-568-B.1 Standards that incorporate link performance testing through entire path, including cable, couplers, and jumpers.
  - 3. ACCEPTANCE: Acceptance of the Data Communications System, by OWNER, shall be based on the results of testing, functionality, and receipt of documentation.
- C. Reports (non-LAN cable): Testing organization shall maintain a written record of observations and tests, report defective materials and workmanship, and retest corrected defective items. Testing organization shall submit written reports to ENGINEER.



END OF SECTION

## SECTION 16130

### RACEWAYS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Raceways for electrical wiring. Types of raceways in this Section include the following:
  - 1. Liquidtight flexible conduit.
  - 2. Underground plastic utilities duct.
  - 3. Rigid metal conduit.
  - 4. Rigid nonmetallic conduit.
  - 5. Electrical nonmetallic tubing.
  - 6. Conduit bodies.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product data for the following products:
    - a. Conduit.
    - b. Conduit bodies.

##### 1.03 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
  - 2. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL, ETL, or CSA.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Conduit:
    - a. Allied Tube.
    - b. Carlon.
    - c. General Electric Co.
    - d. Johns Manville.

- e. Occidental Coatings.
- f. Orangeburg.
- g. Perma-Cote Industries.
- h. Republic Steel.
- i. Robroy Industries.
- j. Steelduct Co.
- k. Triangle Conduit.
- l. Wheatland Tube.
- m. Youngstown Sheet and Tube.
- 2. Liquidtight Conduit:
  - a. Anamet, Inc.
  - b. Carlon.
  - c. Electric-Flex.
  - d. Thomas and Betts.
- 3. Conduit Bodies:
  - a. Adalet-PLM.
  - b. American Electric.
  - c. Appleton Electric Co.
  - d. Carlon.
  - e. Crouse-Hinds Division, Cooper Industries, Inc.
  - f. Delta Industrial Products.
  - g. Killark Electric Mfg. Co.
  - h. Kraloy Products Co.
  - i. O-Z/Gedney Co.
  - j. Perma-Cote Industries.
  - k. Robroy Industries.
  - l. Spring City Electrical Mfg. Co.

## 2.02 METAL CONDUIT AND TUBING

- A. Rigid Metal Conduit: Rigid Aluminum
- B. Liquidtight Flexible Metal Conduit and Fittings: UL 360. Fittings shall be specifically approved for use with this raceway.

## 2.03 NONMETALLIC CONDUIT AND DUCTS

- A. Rigid Nonmetallic Conduit (RNC): NEMA TC 2 and UL 651, Schedule 80 PVC.
- B. Liquidtight Flexible Nonmetallic Conduit and Fittings: UL 1660. Fittings shall be specifically approved for use with this raceway.

## 2.04 CONDUIT BODIES

- A. Provide matching gasketed covers secured with corrosion-resistant screws. Use cast covers in NEMA 4 areas and stamped steel covers in NEMA 1 and 12 areas. Use nonmetallic covers in NEMA 4X areas and threaded, ground joint covers in NEMA 7 and NEMA 9 areas.

- B. Metallic Conduit and Tubing: Use metallic conduit bodies as follows:
1. Rigid Metal Conduit: Use cast or malleable iron conduit bodies with zinc electroplating, aluminum enamel or lacquer finish, and threaded hubs.
  2. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies conforming to UL 514 B.
  3. NEMA 7 and NEMA 9 Areas: Use materials conforming to UL standards for the area.

### PART 3 - EXECUTION

NOT USED

END OF SECTION

## SECTION 16140

### WIRING DEVICES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section includes the following:
  - 1. Receptacles.
  - 2. Ground fault circuit interrupter receptacles.
  - 3. Snap switches.
  - 4. Wall plates.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product data for each type of product specified.

##### 1.03 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. UL and NEMA Compliance: Provide wiring devices which are listed and labeled by UL and comply with applicable UL and NEMA standards.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Cooper Wiring Devices.
  - 2. Hubbell, Inc.
  - 3. Leviton Manufacturing Co., Inc.

##### 2.02 WIRING DEVICES

- A. Provide devices which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Provide ivory color devices and wall plates except as otherwise indicated.
- B. Receptacles: Provide specification grade or heavy-duty grounding receptacles with the NEMA rating shown on Wiring Device Schedule on Drawings. Comply with UL 498 and NEMA WD1.

- C. Receptacles, Industrial Heavy-Duty: Provide pin and sleeve design receptacles conforming to UL 498. Comply with UL 1010 where installed in hazardous locations. Provide features indicated.
- D. Ground Fault Interrupter (GFI) Receptacles: Provide specification grade or heavy-duty "feed-through" type ground fault circuit interrupter, with integral grounding type NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. Provide units rated Class A, Group 1, per UL Standard 94.3.
- E. Snap Switches: Provide quiet type specification grade or heavy-duty AC switches rated 20A at 120/277 volts AC. Provide single pole, 2-pole, 3-way or 4-way switches as indicated. Comply with UL 20 and NEMA WD1.

## 2.03 WIRING DEVICE ACCESSORIES

- A. Wall plates: Single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plates with engraved legend where indicated. Exterior receptacle covers shall provide rainproof protection while in use. Conform to requirements of Section 16075. Provide plates possessing the following additional construction features:
  - 1. NEMA 12 and Unclassified Areas. Material and Finish: 0.04-inch-thick stainless steel, or 0.04-inch-thick brass, chrome plated.
  - 2. NEMA 4X Area or outdoor areas, Material and Finish: Cast screw cap and cover plate for receptacles. Cast cover plate with lever or plunger operator for switches.

## PART 3 - EXECUTION

NOT USED

END OF SECTION

## SECTION 16270

### TRANSFORMERS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Types of transformers specified, and include the following:
  - 1. Dry-type transformers (lighting transformers).

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product Data: Submit manufacturer's technical product data, including rated kVA, frequency, primary and secondary voltages, percent taps, polarity, impedance and average temperature rise above 40 degrees C ambient temperature, sound level in decibels, and standard published data.
  - 2. Submit manufacturer's Drawings indicating dimensions and weight loadings for transformer installations.
  - 3. Wiring Diagrams: Submit wiring diagrams for power distribution transformers.

##### 1.03 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. NEMA Compliance: Comply with NEMA Standard Pub/Nos. ST 20, "Dry-Type Transformers for General Applications," TR 1, and TR 27.
  - 2. UL Compliance: Comply with applicable portions of ANSI/UL 506, "Safety Standard for Specialty Transformers. Provide power/distribution transformers and components which are UL listed and labeled.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. EATON.
  - 2. GE.
  - 3. Square D Company.

## 2.02 POWER/DISTRIBUTION TRANSFORMERS

- A. Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.
- B. Dry-Type Distribution Transformers (45 kVA or less): Provide factory assembled, general purpose, air cooled, dry-type distribution transformers where shown; of sizes, characteristics, and rated capacities indicated, single phase, 60 hertz, 10 kV BIL, 4.0 percent impedance, with 480 volts primary and 240/120 volts secondary; or K-rated 13 three-phase, 60 hertz, 10 kV BIL, 4.0 percent impedance with 480-volts delta connection primary and 208/120 volts secondary wye connected. Provide primary winding with 4 taps; 2 to 2-1/2 percent increments above and below full-rated voltage for de-energized tap-changing operation. Insulate with Class 150 or 220 degree C insulation and rate for continuous operation at kVA, and limit transformer temperature rise to maximum of 115 or 150 degrees C, respectively. Provide terminal enclosure, with cover, to accommodate primary and secondary coil wiring connections and electrical supply raceway terminal connector. Equip terminal leads with connectors installed. Limit terminal compartment temperature to 75 degrees C when transformer is operating continuously at rated load with ambient temperature of 40 degrees C. Provide wiring connectors suitable for copper or aluminum wiring. Cushion-mount transformers with external vibration isolation supports; sound-level ratings not to exceed 45 db as determined in accordance with ANSI/NEMA standards. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap. Provide transformers with fully enclosed sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure. Provide transformers suitable for wall mounting.
- C. Finishes: Coat interior and exterior surfaces of transformer, including bolted joints, with manufacturer's standard color baked-on enamel.

## PART 3 - EXECUTION

NOT USED

END OF SECTION



## SECTION 16410

### CIRCUIT AND MOTOR DISCONNECTS

#### PART 1 - GENERAL

##### 1.01 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product data for each type of product specified.
- B. Operation and Maintenance Manuals: Submit in accordance with requirements of Sections 01600 and 13410, operation and maintenance manuals for items included under this Section, including circuits and motor disconnects.

##### 1.02 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. Electrical Component Standards: Provide components which are listed and labeled by UL. Comply with UL Standard 98 and NEMA Standard KS 1.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. EATON
  - 2. GE.
  - 3. Siemens, Inc.
  - 4. Square D Company.

##### 2.02 CIRCUIT AND MOTOR DISCONNECT SWITCHES

- A. Provide NEMA 4, 4X, 7, 9, or 12 enclosure to match the rating of the area in which switch is installed. For motor and motor starter disconnects through 100 horsepower, provide units with horsepower ratings suitable to loads. For motor and motor starter disconnects above 100 horsepower, clearly label switch, "DO NOT OPEN UNDER LOAD."
- B. Circuit Breaker Switches: Where individual circuit breakers are required, provide factory-assembled, molded-case circuit breakers with permanent instantaneous magnetic and thermal trips in each pole, and with fault-current limiting protection, ampere ratings as indicated. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Provide push-to-trip feature for testing and exercising circuit breaker trip mechanism. Construct breakers for mounting and operating in any physical position and in an

ambient temperature of 40 degrees C. Provide with AL/CU-rated mechanical screw type removable connector lugs.

C. Non-fusible Disconnects: (Heavy-duty) switches of classes and current ratings as indicated.

## 2.03 ACCESSORIES

A. Special Enclosure Material: Provide special enclosure material as follows for switches indicated:

1. Stainless Steel for NEMA 4X switches.

## PART 3 - EXECUTION

NOT USED

END OF SECTION

## SECTION 16440

### PANELBOARDS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section includes the following:
  - 1. Lighting panelboards.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Manufacturer's product data on panelboards and enclosures.

##### 1.03 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. UL Compliance: Comply with applicable requirements of UL 67, "Electric Panelboards," and UL's 50, 869, 486A, 486B, and 1053 pertaining to panelboards, accessories, and enclosures. Provide panelboard units which are UL listed and labeled.
  - 2. NEMA Compliance: Comply with NEMA Standards Pub/No. 250, "Enclosures for Electrical Equipment (1,000 Volts Maximum)," Pub/No. PB 1, "Panelboards," and Pub/No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less."
  - 3. Federal Specification Compliance: Comply with FS W-P-115, "Power Distribution Panel," pertaining to panelboards and accessories.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. EATON
  - 2. GE.
  - 3. Siemens, Inc.
  - 4. Square D Company.

##### 2.02 PANELBOARDS

- A. Except as otherwise indicated, provide panelboards, enclosures, and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; with design and construction in accordance with published product information. Equip with proper

number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.

- B. Lighting Panelboards: Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, and types shown; with anti-turn solderless pressure type lug connectors approved for use with copper conductors. Construct unit for connecting feeders at top of panel; equip with copper bus bars, full-sized neutral bar with bolt-in type heavy-duty, quick-make quick-break, single pole circuit breakers, and toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required and provide bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate and match properly with panelboards. Panelboards and circuit breakers shall be braced for 10,000 rms symmetrical amperes fault current unless otherwise indicated.
- C. Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code gauge, minimum 16-gauge thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable trim clamps and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as indicated. Equip with interior circuit directory frame and card with clear plastic covering. Provide baked gray enamel finish over a rust-inhibitor coating. Design enclosures for recessed or surface mounting as indicated. Provide enclosures which are fabricated by same manufacturer as panelboards, which mate and match properly with panelboards to be enclosed.
- D. Molded-Case Circuit Breakers: Provide factory assembled, molded-case circuit breakers of frame sizes, characteristics, and ratings, including rms symmetrical interrupting ratings indicated. Select breakers with permanent thermal and instantaneous magnetic trip, and with fault-current limiting protection, ampere ratings as indicated. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make quick-break action and positive handle trip indication. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40 degrees C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.
- E. Ground Fault Protected Breakers: Provide UL Class A protected GFI breakers with 6 mA for personnel protection, and for general-purpose receptacles. For breakers dedicated to equipment (sump pumps, heat trace, etc.), provide breaker with 30 mA equipment protection.
- F. Accessories: Provide panelboard accessories and devices including, but not necessarily limited to, ground-fault protection units or circuit breaker locking hardware as indicated.
- G. Spares: In each panelboard provide 8 installed, single pole, 20A spare circuit breakers unless otherwise indicated.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF PANELBOARDS

- A. Type out panelboard's circuit directory card upon completion of installation Work.

END OF SECTION

## SECTION 16510

### LIGHTING FIXTURES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Types of lighting fixtures, including:
  - 1. LED Light Fixtures
- B. Applications of lighting fixtures required for this Project include:
  - 1. Interior lighting.
  - 2. Exterior lighting.
  - 3. Emergency lighting.

##### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Section 01340, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:
  - 1. Product Data: Submit manufacturer's product data and installation instructions on each type lighting fixture and component. Assemble in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. Indicate voltage, bulb type, and wattage.
  - 2. Illumination Data: Provide isofootcandle (isolux) plot diagram of footcandles on horizontal pavement surface which shows values of illuminance projected from indicated fixture heights for roadway and parking area lighting.
- B. Operation and Maintenance Manuals: submit in accordance with Section 01600, operation and maintenance manuals for items included under this Section. Include maintenance data and parts list for each lighting fixture and accessory, and troubleshooting maintenance guide

##### 1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of equipment, of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
  - 1. NEMA Compliance: Comply with applicable requirements of NEMA Standards Pub/No. LE 2 pertaining lighting equipment.
  - 2. IES Compliance: Comply with IES RP-8, 19, 20, and PB-15 pertaining to exterior, parking, and roadway lighting practices and fixtures.
  - 3. UL Compliance: Comply with requirements of UL standards, including Standards 486A and B, pertaining to lighting fixtures. Provide lighting fixtures and components which are UL listed and labeled.

4. NFPA Compliance: Comply with applicable requirements of NFPA 78, "Lightning Protection Code," pertaining to installation of exterior lighting fixtures.
5. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  1. Lighting Fixtures:
    - a. See Luminaire Schedules on Drawings.
  2. Emergency Lighting:
    - a. Dual-Lite, Inc.
    - b. Holophane Lighting.
    - c. Hubbell, Inc.
    - d. Lithonia Lighting.

### 2.02 EXTERIOR LIGHTING FIXTURES

- A. Provide lighting fixtures of sizes, types, and ratings indicated on Luminaire Schedule on Drawings, complete with, but not limited to, housings, energy efficient ballasts, starters, and wiring.

### 2.03 INTERIOR LIGHTING FIXTURES

- A. Provide lighting fixtures of sizes, types, and ratings indicated on Luminaire Schedule on Drawings, complete with, but not limited to, housings, energy-efficient lamps, lamp holders, reflectors, energy-efficient ballasts, starters, and wiring. Ship fixtures factory assembled with components required for a complete installation. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast-generated noise.

### 2.04 EMERGENCY LIGHT SET, GENERAL PURPOSE

- A. Self-contained, surface wall-mounted with 2 lamp heads, and having the following features unless otherwise indicated:
  1. Housing: 14-gauge steel or high-impact, injection-molded structural foam or fiberglass reinforced thermoplastic. Provide NEMA enclosure rating suitable for location in which unit is installed.
  2. Indicator Light for High Charge Rate and Test Switch: On front panel, with concealed terminals for remote lamp heads.
  3. Integral Lamp Heads: Mounted on housing with 180-degree 2-way, locking swivel joints for aiming. Lamps shall be 12-watt tungsten halogen sealed beam type, or as indicated.
  4. Battery: Sealed, maintenance-free, lead-acid or calcium type, with 10-year pro rata adjustment warranty or 5-year, no charge replacement warranty.
  5. Charger: Minimum 2-rate, fully automatic, solid-state type with sealed transfer relay and fused output circuits.

6. Finish: Manufacturer's standard for exposed parts, baked enamel on steel.
7. Operation: Relay turns lamps on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamps operate for duration of outage, up to 1.5 hours. Lamps automatically disconnect from battery when voltage approaches deep-discharge value. When normal voltage is restored, battery is automatically recharged within 16 hours and maintained on trickle charge.

## 2.05 EMERGENCY LIGHT SET, EXIT SIGN

- A. Self-contained, AC battery-illuminated exit sign unit, universal mounting with downlight. Provide NEMA enclosure rating suitable for the location in which unit is installed.
  1. Lamps: Manufacturer's standard, furnished with unit.
  2. Style, shape, trim, material, finish, and arrangement of housing as indicated.
  3. Faceplate: High-impact, UL 94 V-O rated, plastic with snap-out arrows and color of letters as indicated.
  4. Mounting provisions shall suit individual installation conditions.
  5. Battery: Sealed, maintenance-free, lead-acid or calcium type, with 10-year pro rata adjustment warranty or 5-year no charge replacement warranty.
  6. Charger: Minimum 2-rate, fully automatic, solid-state type with sealed transfer relay.
  7. Finish: Matte white for exposed parts, or as indicated.
  8. Operation: Sign is illuminated by AC-powered lamps under normal conditions. Relay turns emergency lamps on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamps operate for duration of outage, up to 1.5 hours. Lamps automatically disconnect from battery when voltage approaches deep-discharge value. When normal voltage is restored, AC-powered lamps are relighted and DC lamps are switched off. Battery is automatically recharged within 16 hours and maintained on trickle charge.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF INTERIOR LIGHTING FIXTURES

- A. Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements. Field locate fixtures to avoid conflicts with equipment, pipework, etc.

END OF SECTION